BONUS: RAAF F/A 18 Poster

Australia's Top Selling Electronics Magazine Control April 1987 Aust* \$3.50 NZ \$4.95 [Selling Electronics Magazine | April 1987 Aust* \$3.50 NZ \$4.95 [Selling Electronics Magazine | April 1987

AUSTRALIA'S
HIFI
AWARDS

THE WINNERS

Best ☆ Amplifier

Best ☆ Receiver

Best & CD Player

Best & Cassette Deck

gest ☆ Loudspeakers

- How to use your CD player in your car
- Ultrasonic car burglar alarm
- Shure's Ultra D6000 CD player

it's a beauty!

Switch on the future with Siemens relays

Siemens relays are at the heart of many technological advances.

Particularly within the automotive industry where Siemens electromechanical relays contribute to outstanding improvements in safety, fuel economy, convenience and pollution reduction.

That's because of their reliability. economy, compact size, sturdiness, efficiency and low resistance in the contact circuit.

And Siemens has an extensive range of relays for every application. Including solid state relays, which offer significant advantages such as high switching rate, long life, bounce free switching, low spark generation and non inductive input resistance.

Furthermore, Siemens higher technology is currently developing other superior relays which are even more efficient, more reliable and more compact.

And which are switching on the future. For more information, contact your nearest Siemens office.

Siemens Ltd.

544 Church Street, Richmond, Vic.

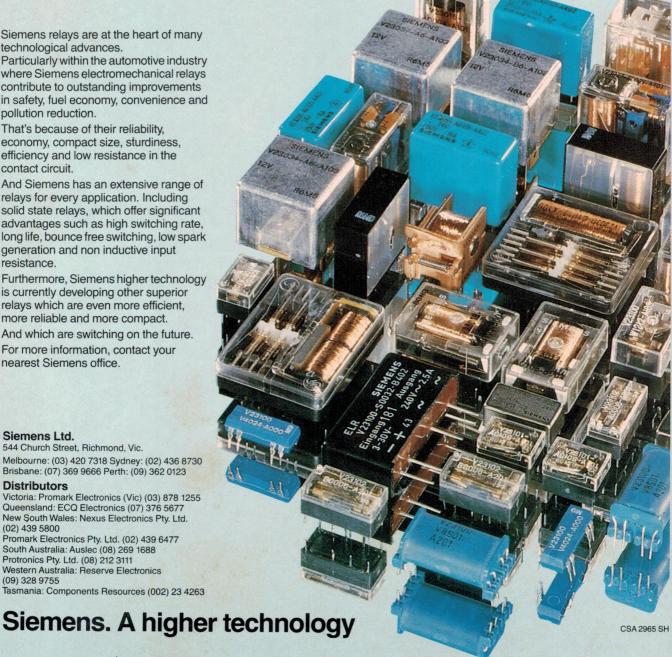
Melbourne: (03) 420 7318 Sydney: (02) 436 8730 Brisbane: (07) 369 9666 Perth: (09) 362 0123

Distributors

Victoria: Promark Electronics (Vic) (03) 878 1255 Queensland: ECQ Electronics (07) 376 5677 New South Wales: Nexus Electronics Pty. Ltd. (02) 439 5800

Promark Electronics Pty. Ltd. (02) 439 6477 South Australia: Auslec (08) 269 1688 Protronics Pty. Ltd. (08) 212 3111 Western Australia: Reserve Electronics (09) 328 9755

Tasmania: Components Resources (002) 23 4263



THIS MONTH'S COVER

Marantz's impressive PM94 stereo amplifier was one of the winners of this year's CESA hifi awards. What makes it so good? — we tell you on page 78.

Volume 49, No.4 FERRITAL April 1987

Features

10 VINTAGE RADIO RESTORATION Technology from the good old days 62 BONUS RAAF F/A18 POSTER Australia's hot new fighter 78 AUSTRALIA'S ANNUAL HIFI AWARDS The best products for 1986

Entertainment Electronics

64 HIFI REVIEW Shure's D6000 compact disc player
102 AN INTRODUCTION TO HIFI PT.12 AM radio tuners
112 COMPACT DISC REVIEWS Mendelssohn, Rachmaninoff, Beethoven

Projects and Technical

28 12/240V INVERTER FOR CD PLAYERS Use it in your car

36 THE SERVICEMAN There's no profit in crook joints

44 ULTRASONIC CAR ALARM Companion to the remote control switch

50 BUILD A DIGITAL METRIC CLOCK Get ready for metric time

68 A TEMPERATURE-CONTROLLED CRYSTAL OVEN Controls drift

96 CIRCUIT & DESIGN IDEAS Nicad charger, V/F converter

100 ESTIMATING NOISE IN OP AMPS Your computer does the maths

News and Comment.

4 LETTERS TO THE EDITOR Australian hobbyists better off

5 EDITORIAL The Australia Card: we don't want a bar of it

6 NEWS HIGHLIGHTS Aussie robots for Ford factory

18 FORUM Audiophiles are not all half-wits!

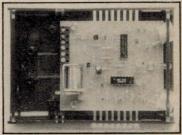
116 INFORMATION CENTRE Answers to reader queries

Departments

63 50 AND 25 YEARS AGO 84 NEW PRODUCTS 108 EA CROSSWORD PUZZLE

120 MARKETPLACE
122 COMING NEXT MONTH
118 NOTES AND ERRATA

Ultrasonic burglar alarm

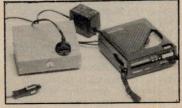


This inexpensive ultrasonic alarm can be used to protect your home or your car. It's also ideal for use with the remote control switch described in January. Details page 44.

RAAF Poster

This month's issue carries a bonus poster of the RAAF's new F/A18 fighter. Unfolded copies of this poster (sent in a mailing tube) are available from "Electronics Australia", PO Box 227, Waterloo, NSW 2017. Price \$5.00 (incl. p&p).

12/240V inverter for portable CD players



Here's how to run your portable CD player from your car's cigarette lighter socket. This project converts the 12V DC battery voltage to 240V AC so that you don't have to rely on rechargeable nicad batteries. See page 28.

MANAGING EDITOR

Leo Simpson, B.Bus. (NSWIT)

Greg Swain, B.Sc. (Hons. Sydney)

EDITORIAL CONSULTANT

Neville Williams, F.I.R.E.E. (Aust.) (VK2XV)

EDITORIAL STAFF

John Clarke, B.E. (Elec. NSWIT) Carmel Triulcio

GRAPHIC DESIGNER

Brian Jones

ART PRODUCTION

Alana Horak

PRODUCTION

Mark Moes

SECRETARIAL

Naomi Lenthen

ADVERTISING PRODUCTION

Brett Baker

Vikki Patching (Vic.)

ADVERTISING MANAGER

Selwyn Sayers

PUBLISHER

Michael Hannan

HEAD OFFICE

The Federal Publishing Company Proprietary Limited, 180 Bourke Road, Alexandria, NSW

Phone: (02) 693 6666. Fax number: (02) 693

2842. Telex: AA74488.

Postal Address: PO Box 227, Waterloo 2017. NSW Representative: Mark Lewis.

INTERSTATE

ADVERTISING OFFICES

Melbourne: 221a Bay Street, Port Melbourne, Vic. 3207

Phone: (03) 646 3111

Representative: John Oliver, B.A. (Hons.

Essex). Adelaide: John Fairfax & Sons Ltd, 101

Weymouth Street, Adelaide, SA 5000. Phone: (08) 212 1212.

Representative: Michael Mullin

Brisbane: 26 Chermside Street, Newstead, Qld. 4006.

Phone: (07) 854 1119.

Representative: Bernie Summers.

Perth: John Fairfax & Sons. 454 Murray Street,

Perth. WA 6000.

Phone: (09) 481 3171.

Representative: Estelle de San Miguel.

New Zealand: 3rd Floor, Communications House, 12 Heather Street, Parnell, Auckland,

New Zealand.

Phone: (09) 39 6096. Telex: NZ 63122

SPORTBY

Representative: John Easton

ELECTRONICS AUSTRALIA is published monthly by the Federal Publishing Company Pty Limited.

Typeset and printed by Hannanprint, 140 Bourke Road, Alexandria, NSW for The Federal Publishing Company Pty Ltd.

Distributed by the Federal Publishing Company Pty Ltd.

Registered by Australia Post — publication No. NBP 0240 ISSN 0313-0150



*Recommended and maximum Australian retail price only



Letters to

Appreciates article on airship

I have just read the excellent article by Terry Ayscough entitled "A Ride the Bond Airship" (EA, February). Obviously, we are very happy for all the media exposure given for the utilisation of airships in the commercial world.

The Australian Airship Association (AAA) was set up as a platform for the exchange of ideas and information relating to the many aspects of lighter than air vehicles. As a service to your readers who may require further information on aerostats, we would gladly be of assistance. If you could publish our address it would be greatly appreciated.

Otto Lechner, President A.A.A., 117 Bielby Rd, Kenmore, Queensland, 4069.

Australian hobbyists better off

I've been following your comments and reader letters on supply of kits in Australia.

In my opinion, Australians are very fortunate to enjoy the availability and variety of relatively low cost kits compared to US enthusiasts. I am familiar with the Australian and American kit industry as I was Dick Smith Electronics' General Manager and Managing Director from 1972-84 in Australia and have been President of Dick Smith Electronics in California during the past two years.

I remember the first kit "assembler" I employed in 1973 at Gore Hill. I didn't know production technique so I sat him on the floor, surrounded him with ten small plastic containers and a parts list, and he sprinkled the required number of parts into each container. That is how primitive it was. When I left DSE Australia in 1984 that one man kit department had grown into a multimillion dollar operation employing 30 people.

There are a number of reasons kits have been so popular and successful in Australia and I believe a lot of this success has been due to the clever liasion between Electronics Australia and the parts supply companies. I know DSE

would not have been as successful without EA and I also believe EA may not have been as successful without the commercial liasion with hobbyist suppliers like DSE.

Electronics Australia has it own design team and this, I believe, acts as a catalyst for ideas and creates a high degree of independence from having to rely solely on projects designed by readers and companies such as DSE. EA is able to "pick the eyes" out of projects offered by outsiders and develop their own unique designs at the same time.

This in-house technical expertise allows EA to test designs offered by others too. As far as I know, EA made sure all major projects worked to spec. before they were published.

By contrast, none of the electronics magazines in the USA design their own projects. As a result, they depend solely on readers and commercial suppliers to provide them with ideas and designs.

This makes it difficult for hobbyists. Pick up any US electronics magazine and try to find where you can buy a complete kit of parts for the project you are interested in building. If there is a supplier, it is usually the author. Problem is, a lot of authors are not businessmen. They don't know how to buy, supply and manage an efficient retail mail order business.

I've known hobbyists to place an order and wait months. Many hobbyists even told me that they gave up building kits because they never were able to get all the necessary parts together.

In Australia, the hobbyist in my opinion is much better off. Pick up EA and look at the number of reputable suppliers where you can buy your kit. If one supplier doesn't kit up for your project another one soon will.

In Australia, DSE used to take the EA article and spend sometimes weeks and thousands of dollars drafting enhanced kit instructions so that constructors wouldn't fall into traps. I always believed the more kits people got working the more excited they would be to continue their hobby. In 1977, I employed an engineer to draft special step by step style instructions for the EA CDI kit, of which we sold over 15,000.

DSE also came up with a "Sorry Dick It Doesn't Work" coupon: if you couldn't get your kit to go, we'd fix it for a fee and return it working. There was also a 7-day satisfaction guarantee: if you bought a kit, you had seven days to look over the instructions and if you thought it was too complicated you could return it for a refund. Before DSE opened in the USA, this service was unavailable for magazine kit projects.

In my opinion, the Australian electronics hobbyist is in Utopia. If you enjoy building, support EA and the kit suppliers. Sure the system has flaws but I think it is the best in the world.

Ike Bain, Dick Smith Electronics, Palo Alto, California.

Target areas of Radio Australia

I read with interest the problems faced by M.A. Young (January issue) in his attempts to listen to the English Language Service of Radio Australia.

As the writer correctly states, Europe is not one of Radio Australia's prime target areas although we often receive reports from our European listeners indicating good reception. We agree that the crowded shortwave spectrum in Europe is a contributing factor to reception problems, as are ionospheric conditions. It seems that a combination of these factors were responsible for your writer's lack of success.

Radio Australia's prime target areas are in Asia and the Pacific where we broadcast to a large and loyal audience in Indonesian, Standard Chinese, Cantonese, Thai, Vietnamese, Japanese, French, Neo-Melanesian Pidgin and basic English

basic English.

It is sometimes possible to listen to these programs within Australia, bearing in mind the fact that they are directed out of Australia and not aimed at an Australian audience. Travellers in Australia are able to hear our English service between midnight and dawn through ABC medium-wave transmitters in the Northern Territory.

Your readers will be only too aware of the financial restraints that the ABC is operating under and these are also limiting the service that Radio Australia would seek to provide for its listeners.

I might add that whilst Radio Australia provides the programs and studio facilities, the transmission side is handled

continued on page 110



Editorial Viewpoint

The Australia Card: we don't want a bar of it!

The heading of this editorial will surprise readers who saw my editorial of July 1985. In that issue I wrote supporting the general concept of identity cards. I took the view that tax evasion, social security fraud and law enforcement were serious problems confronting the Australian people and that the creation of a large database would go a long way to make the country less "ungovernable". It would be a good and desirable application of available computer technology. I also took the view that the average law abiding person had little to fear from the introduction of ID cards.

Well, dear readers, I was wrong. I have now seen the Australia Card Bill 1986 and I am horrified. If this bill ever becomes law we will have *Big Brother* with a vengeance. The proposed legislation is far more reaching and draconian than I had ever dreamt.

The Australia Card itself will have no information on it, apart from your name, photograph and your address. But it will be the key to a bank of information on births, deaths, marriages.

The Australia Card will need to be produced before any transactions can be made in any of the following categories: health insurance, social security, hospital admissions, Medicare claims, passport applications and immigration, accounts and deposits with all financial institutions, income from trusts, investments, real estate transactions (ie, leases and purchases), employment applications, safety deposit boxes, foreign remittances, shares in public companies, futures contracts, prescribed payments, rental income, and primary production income. The Australia Card will thus be a licence to perform virtually every essential activity, where no licence was required before.

Each transaction will be accompanied by your Australia Card number and will thus be the key to virtually all your life's activities. Many Government

departments will inevitably have access to this information.

The proponents of this legislation will no doubt cite the provisions in the Bill to ensure privacy, notably the proposed Data Protection Agency but anyone with any knowledge of computers must know the difficulties of ensuring privacy when so many people will have access to the data.

The proponents can also point to the use of ID cards in many countries in the world but no country's card, to my knowledge, is backed by such a com-

prehensive store of data on each and every person.

There are clauses in the legislation which would easily enable any future totalitarian Government to withdraw your Card, which would be tantamount to removing your citizenship. And consider the Orwellian overtones of the legislation; throughout the Bill people are referred to as "Card-subjects".

The more you look at the legislation, the more you must conclude that it would be very bad for the rights and privacy of future generations. No or-

continued on page 110

News Highlights

Aussie robots for Ford factory

An Australian company, Machine Dynamics, has been commissioned by the Ford Motor Company of Australia to supply two robot assembly systems for Ford's Victorian operation.

The contract, which is worth more than \$5 million, involves the design, manufacture and installation of 22 gantry robots with auxiliary gripping, tooling and positioning devices.

The project will take about twelve months to complete and the result will be two fully integrated production lines.

On one line, the robots will transfer

door components for the 1988 Falcon and Fairlane ranges between robot spot welding stations, adhesive applications and a 200 tonne press.

On the other line, the Machine Dynamics robots will transfer front fender aprons during assembly. The robots will be capable of processing the left or right fender aprons individually or both simultaneously.

Ford has also recently placed an order with ASEA Pty Ltd for 76 robots to automate spot welding, arc welding and gluing of car bodies.

Speeding things up with Fastext

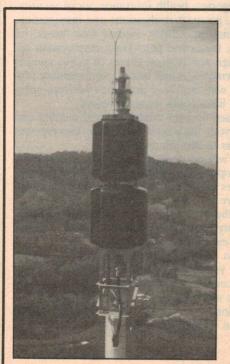
The Thorn-EMI Ferguson group in the UK is soon to release a new kind of teletext television set. This new system, called Fastext, has been jointly developed by TV set manufacturers and engineering staff at the BBC and ITV.

It is designed to overcome the current broadcast teletext bugbear of slow page selection — or at least provide a partial answer.

The system operates by linking four teletext pages together and equipping them with additional digital codes.

These codes are recognised by additional circuitry in the receiver which then automatically stores the linked pages in memory.

What this now means is that the next page in a sequence can be quickly recalled from memory. By contrast, in the standard system, the selected page would not appear until it was the turn of that page to be transmitted. This could take around 20 seconds or more, depending on the number of page in the magazine.



UHF TRANSLATOR

SITTING HIGH above the surrounding countryside near Coffs Harbour in Northern NSW. this new UHF translator antenna is made up of eight panel arrays designed and manufactured by Antenna Engineering Australia Pty Ltd. According to AEA, the design covers the full UHF band and features excellent azimuth variation and VSWR. AEA is a major antenna manufacturer and has recently also been involved in the installation of Band III VHF arrays for TVW7 Perth, HSV7 Melbourne, and QTQ9 Brisbane. Other recent contracts include the supply of antennas to the Broadcasting Corporation of New Zealand for FM services throughout that country and new arrays for Indonesian Television in Sumatra and Kalimantan.

Matsushita markets digital VCR

The Matsushita Electric Industrial Company has released its first digital VCR onto the Japanese market.

Called the NV-D21, it has an 8-event 4-week tuner and barcode scanner. Other features include a nine-window split-screen capability and nine 128K-bit RAMS, the largest memory capacity in the industry. This allows still motion for each window as well as strobe, rapid search and multi-tuning.

BWD takes over James Hardie Electrical

Ownership of the Electrical Division of James Hardie Industries Ltd was recently transferred to BWD Industries Ltd as an on-going concern.

An agreement between the two parties for the take-over had been settled prior to Christmas.

The Electrical Divison will be known as Wilco Electrical Pty Ltd and will continue to run as a wholly owned but autonomous company.

BWD Industries Ltd is an Australian owned technology and marketing based company. The inclusion of Wilco Electrical Pty Ltd into the group is seen as providing an excellent strategic fit between BWD Industries Ltd other subsidiaries and associated companies such as Swann Electronics, BWD Precision Instruments and ELPEC.

New owner for George Brown

The George Brown Group, a major Victorian component distributor, has been purchased by the Falkiner Group and has announced significant expansion plans.

Among several recent moves, the company has entered into a Volume Purchasing Agreement with Fairchild, which will offer the industry off-theshelf, high end Fairchild products at competitive prices. The company will also be selling the NEC range of hard and floppy disc drives, and has entered into an agreement to distribute the new range of fibre optics equipment from Thomas & Betts, as well as an increased variety of IDC and surface mounted components. To accommodate the increased activity, George Brown has moved to larger more modern premises. The new address is Unit 7, 2-6 Apollo Court, Blackburn, Vic. 3130.

Big sales predicted for car telephones

Demand for car telephones is expected to increase significantly following the launch of the much-heralded cellular mobile telephone system.

Sydney and Melbourne were the first Australian cities to come on stream, with launches in February and March respectively. The system will be progressively introduced to other state capitals by year's end.

The new cellular telephone system is vastly superior to the two-way MTS (Mobile Telephone System) car radio network currently in use. It operates in the 800MHz band and is based on a series of transmitters which transmit and receive calls within set areas (or cells) varying in size from around 2km to 12km, depending on population density.

Each cell in the local network is tied into a central computer or Mobile Service Switching Centre (MSSC). Here the calls are automatically processed, the caller identification made and the call routed through the public telephone network.

As the car moves out of one cell and into another, the MSSC detects the fad-



ing signal and switches to the next cell with no perceptible interruption to the signal. Users can make or receive local, STD or ISD calls as if they were using a normal home or business phone.

The cellular system was first introduced in the United States four years ago and has proved so successful that sales have now reached 25,000 units a month. Australian predictions are equally impressive. Telecom expects 10,000 units to be in use after the first year of operation and 200,000 within five years.

The system is not exactly cheap, though. Prices start at around \$3600 (includes installation) and users must may a network fee of \$50 per month.

Double scanning for clearer TV pictures

TV screens are being enlarged to enhance the enjoyment of not only TV proadcasting but various media such as video-cassette and videodisc programming. Along with this trend towards larger screens is a demand for better picture quality.

One Japanese company, Toshiba, has recently developed a new range of colour TV sets with high-quality picture resolution. The new sets employ a new double scanning method and a high-contrast, "full-square" picture tube. The re-

sult, according to Toshiba, is a much-improved picture.

Toshiba doubled the scanning lines by using two semiconductor chips called line memories in a digital memory circuit. In the double scanning method, each line is scanned twice to fill in the space which conventional TV leaves between the scanning lines as a gap.

As seen in Fig.1, while the line memory 1 is reading in the video signal of the scanning line at a given moment, line memory 2 reads out the previous

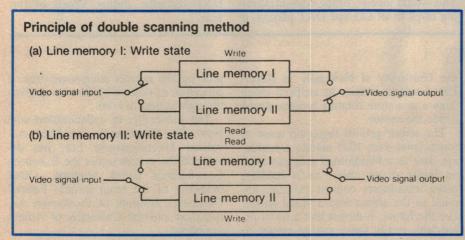
line (a). And, while line memory 1 reads out the scanning line, line memory 2 reads in the next line (b). These functions are then repeated.

Although the number of the scanning lines in one field is twice as great with double scanning, the number of scanning lines in one frame remains 525 (NTSC system) because the two fields are overlapped to make one picture.

Supercomputer for CSIRO

The purchase of a Control Data 205 supercomputer has just been announced by the CSIRO. Costing some \$3.7 million, the new machine has a 16 million byte memory and is able to perform 400 million calculations per second at peak operating speed.

Operation of the machine will be controlled by the CSIRO's independent computing company, CSIRONET, which has been renting the machine for the past two years. The supercomputer is used primarily by CSIRO and university researchers, government departments such as the Bureau of Meteorology and, increasingly, private companies.



News Highlights

Remote-controlled vehicle for North America

The Minister for Defence, Mr Kim Beazley, recently announced that offsets would be used to boost marketing in North America of Australian-designed and built remote-controlled underwater vehicles.

As part of the offset obligation resulting from acquisition of 75 F/A-18 Hornets for the RAAF, the US-based McDonnell Douglas Corporation is to provide marketing support to the Western Australia company Underwater Systems Australia Ltd (USAL).



The initial marketing emphasis will be on the USAL designed C-Cat and Super C-Cat vehicles, which are fitted with video cameras and lights for relatively shallow water applications.

Under the arrangements established for the Hornet program, McDonnell

Douglas has an obligation to place offset orders with Australian industry to the value of 30% of the project cost. The bulk of the offset program will be achieved through local production of F/A-18 components or work of similar technology.



DAT at conference table

The DAT (Digital Audio Tape) problem has all the makings of a major row. On the one hand, the audio equipment industry (read the Japanese) want to market DAT to open a new area of demand. On the other hand, the software industry wants to prevent copyright infringements by banning DAT if necessary.

A conference was recently held in Vancouver, Canada, to discuss both sides of the problem. The Japanese were looking for definite answers on such things as copycards, payment of copyright fees for dubbing of video or audio products, and the possibility of launching DAT in the near future.

At the same time, the Recording Industry Association of America (RIAA) has called for the banning of the DAT unless there is a recording spoiler to prevent recording from compact discs. This would involve fitting copy-preventing chips to all CD and DAT players, a

proposal that is being strenuously resisted by equipment manufacturers.

One thing is certain — DAT cannot succeed without the cooperation of both industries.

Meanwhile, in anticipation of the release of DAT, companies such as TDK Corporation, Sony Corporation, Hitachi Maxell Limited, Fuji Photo Film Company, the Matsushita Electric Industrial Company, Victor Company of Japan and the Taiyo Yeuden Company are moving to commercialise the digtial audio tape cassette.

The cassette uses pure iron metal powder and the same tape width (3.81mm) as current compact cassettes. The recording system has a tape speed of 8.15mm per minute, sampling frequency of 48kHz, linear quantization of 16 bits, track pitch of 13.59 microns, and a line density of 64KB per inch.

Late news to hand is that Aiwa was planning to be the first to release a DAT recorder, during March of this year.

Robot with a human touch

A highly developed sense of touch and artificial vision enables this robot to choose any component it wants from among a collection of mixed objects.

When a human picks up and handles any object, his hand is guided nearly all the way by his sense of sight and the position of his arm. But the final approach and the actual grasping is guided by the sense of touch. The tactile sensor, developed by the Department of Electrical and Electronic Engineering at

the University of Newcastle in North-East England, obtains its artificial vision from a miniature rotating camera placed inside the sensor.

The sensor gets its finger-tip sense of touch from over 1000 minute transducers. Just as a blindfolded man can form an image of an object he is holding, these transducers convert pressure applied to the sensor into a visual image. For the future, it means that a robot fitted with tactile sense can be taught to

pick up the correct component from a collection of objects by first being given the right object to hold.

The university, in collaboration with Newcastle Polytechnic and Mari Advanced Microelectronic Ltd, has developed the system under the European Community's Esprit program. Other members of the team include Federal Germany's Institute of Production Automation and the University of Athens in Greece.



Technology from the good old days

Vintage radio restoration

There are many old-time valve radio receivers collecting dust in garages and antique shops. Collecting and restoring these old radios can be a rewarding and interesting experience.

by JOHN HILL

Collecting and restoring various items from our past is a popular hobby for many. Typical collectors items include old cars, motor cycles, clocks, furniture — you name it and someone somewhere collects it.

Although I always considered myself immune to such childish behaviour, I now have to admit that I have been bitten by the collecting bug, with my particular interest centring around old valve radios. One of the most pleasing

aspects of my new hobby is that it appears as though I have become interested in it at about the right time.

Unlike vintage motor cars (which are now almost impossible to find), there are stacks of old radios around and they are not only easy to locate, but relatively inexpensive to buy.

To give an example of old radio availability, I recently managed to obtain 32 complete sets during a two week holiday period. The average price was \$8.00

which, as far as hobbies are concerned, isn't costly by any means. In some instances, people are happy to give away their old radios just to get rid of them.

The price of old radios is something that varies considerably. Radios in working order are worth more than those that aren't; wooden cabinets are more desirable than plastic; console models bring more than mantle models; while the true vintage radios of the 1920s are worth ten times as much as sets of the 1930s era or later.

Realistically, an old radio is only worth whatever someone is prepared to pay for it and, in the case of valve radios, not many people place much value on them at all. Many old radios, often in working order, are disposed of at the tip. Others find their way into the hands of dealers.

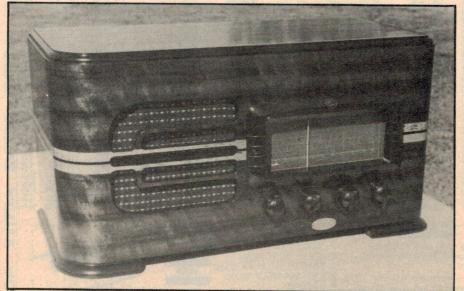
Dealer prices

Dealer prices are in accordance with demand and the guys I buy from don't seem to have much demand. Then again, I only buy sets that no longer work and most of these sell for around \$10 or less. However, 20 years from now, the situation could change dramatically.

George is an antique dealer I buy a few radios from and a typical transaction goes something like this: "How much is the old radio, George?"

George rarely replies, but plugs the set into the power point to see if it goes. He never seems to find the time to do this until it looks as though someone might buy it. In most instances the radio fails to respond and appears to be quite dead.

"You can't ask much for them when they don't work, can you George?" is my standard remark after about a minute of silence from both George and the radio.



A four valve battery operated Hotpoint. Battery sets offer special problems to radio restorers in that they require a 90-135 volt "B" battery.

Eventually George finds his voice and mutters something like "How does five dollars sound?"

I buy a lot of radios from George because he is realistic with his prices and he is able to scrounge around at auctions and sales for me. Buying from the right antique dealer is perhaps the easiest way of getting onto old radio sets.

One striking aspect of valve radio is the quality of the sound. The cheap transistor radio has been with us long enough for most of us to forget just how good many valve radios were. Some of the larger console models have 25-30cm loudspeakers in them and the sound has to be heard to be believed.

Perhaps the tragic part of collecting these old radios is the constant reminder that the majority of them were entirely made in Australia. Like so much of Australian industry, radio manufacturers have gone down the gurgler and what was once a thriving industry has faded away to almost nothing. Sounds a familiar story, doesn't it? At least radio collectors are preserving a unique piece of Australian history.

Anyone starting out on the radio restoration caper will find that they are pretty much on their own, unless they happen to have a few of the right contacts. It is most important that they will be able to do their own repairs, because most people in the trade don't want to see a valve radio, let alone repair it. The average radio-TV repair man has no valves, suitable spares or desire to work on old radios.

Radio restoration is similar to vintage car restoration in that the restorer has to utilise secondhand bits and pieces to best advantage. Not many modern components can be used in valve radios and one usually has to make do with cannibalised parts from other receivers.

Valves

Valves in particular present a major problem to restorers in that no-one makes, stocks or sells them any more. Some of the older repair places may have a few valves on a dusty shelf, but they are mainly TV valves and the old radio valves of the 1930s and 40s never seem to be there.

It is therefore important, when starting out, to buy up all the old wrecked sets one can lay hands on. Radios with smashed cabinets, broken dials and missing knobs can usually be bought for \$2 or so and are an essential part of collecting. Wrecked and unrestorable radios are about the only supply of valves and other spare parts one is likely to find and as such are almost as



Vintage receivers like this late 1920s Seyon are few and far between. This one is a three valver with a separate loudspeaker.



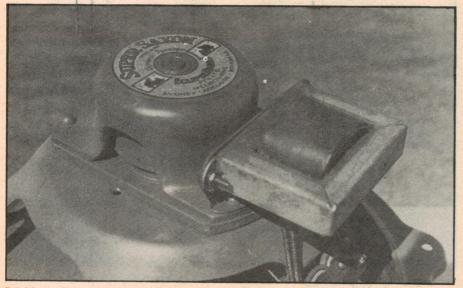
Old paper capacitors should be replaced with high voltage (400-630V) polyester equivalents.



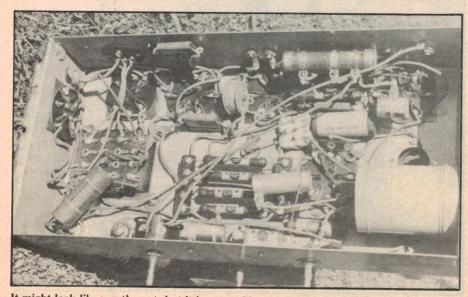
Old valve manuals are an essential part of a restorer's equipment.



Radio wrecking is about the only supply of usable secondhand parts.



Double trouble with old radios. Both the loudspeaker field coil and loudspeaker transformer can burn out and give trouble.



It might look like a rat's nest, but it is accessable and easy to service.

valuable as restorable radios.

Secondhand valves can vary from totally useless to perfectly OK, with varying degrees in between. But while buying up wrecks is one way of obtaining valves, there are also other sources of supply.

Believe it or not, there are numerous people in the community with valve collections. Retired radio repairmen and others who have been in the trade sometimes have sheds full of bits and pieces and are glad of the opportunity to sell it or even give it away. They never thought they would meet anyone silly enough to actually want the stuff.

I have located and obtained three such valve collections and all were within one kilometre of where I live. If I can do that so close to home, then there must be other collections around just waiting for a bid. An advertisment in a newspaper could bring results.

Buying out a few valve collections can give one's own collection a considerable boost and increase the scope of restorations. To get properly organised, a valve collection needs to be tested, cleaned, sorted and cataloged. There is nothing worse than a great assortment of unknowns. My own valve collection numbers many hundreds and is still growing.

Testing valves is a problem and the best that the average restorer can do without a valve tester is to check the filaments or heaters for continuity, then plug the valves into a radio that is in good working order. If a valve works, well and good; if it doesn't, then discard it.

Unfortunately, if just starting out, one may not have many radios that can be used as valve testers. Collectors in this situation will have to do the best they can.

A supply of usable valves, whether new or secondhand, is of the utmost importance to the valve radio restorer. Without valves, valve radio ceases to exist.

Most old valve radios don't work when first salvaged and plugging them into the 240V power supply can do serious damage. In some instances, time and non-use have a bad effect on ageing components and it is advisable to give a set a thorough check out before plugging it in. Checking out the valves and cleaning the base pins and sockets is a good starting point.

Capacitors

One of the most common causes of trouble with vintage radios is with the

capacitors. The two types that cause trouble are the paper capacitors (referred to as "condensers" in the good old days) and the electrolytics. Mica capacitors are unlikely to give trouble. Let's take a close look at these troublesome components and see what problems they cause and how these problems can be resolved.

Paper capacitors are so named because the dielectric insulating the two layers of foil is made of waxed paper (no fancy plastic in the early days of radio). Unfortunately, age and high voltage application causes the wax paper to break down and most old paper capacitors have serious leakage problems. In many instances they become resistors and allow sufficient current to flow to register on an ohmmeter. Readings of $500 k\Omega$ to $2 M\Omega$ are quite common when checking old paper capacitors.

Now if a capacitor leaks when a few volts from an ohmmeter is put across it, what's it going to do if put back into service with several hundred volts across it? That's right — ZAP!.

It is wise to replace paper capacitors with modern high voltage equivalents. If all paper capacitors are not replaced, then at least replace those with any measurable leakage. If one wishes, low voltage paper capacitors can be replaced with 100V capacitors which are cheaper to buy.

Another good reason for checking out the paper capacitors is that many of them have been chewed by rats and mice while the set spent 20 years or so in someone's shed. Vermin are quite fond of the wax coating on paper capacitors and it is not uncommon to find some capacitors have been eaten away.

Electrolytic capacitors, whether vintage or modern, contain a fluid which eventually leaks away or dries out over a period of time, thus rendering the capacitor useless.

Old electrolytics are a mixed bag; some still work OK after 40 years, while others are completely clagged at half that age. Some become open while others short circuit. Once again, the replacement of old electrolytics is an excellent idea and can prevent a lot of trouble.

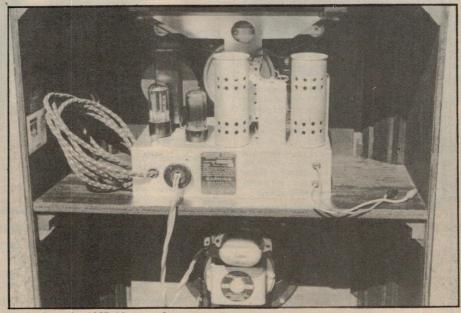
Unfortunately, old radios use different electrolytics to the ones usually encountered in modern circuits. Valve radios require electrolytics with voltage ratings ranging from 350 volts to 600 volts. Obtaining these high voltage electrolytics is a bit like trying to buy new valves, in that no one seems to manu-



Valves come in many shapes and sizes.



Old style body, end and dot resistors.



Back view of a 1937 Airzone after restoration.

CHIPS

FOR (

WOOD

FOR CHIPS

MOOD

CHIPS ...

FOR

WOOD

CHIPS

FOR

WOOD

WOOD FOR CHIPS

WOOD FOR CHIPS

WOOD FOR CHIPS

CHIPS

FOR

DOOW

WOOD FOR CHIPS

CHECK TRANSISTORS, CAPACITORS AND **CURRENT TO 10A**

One multimeter does the lot - Vdc from 200mV to 1000V, Vac from 200mV to 750V, Adc from 200uA to 10A, Aac from 20mA to 10A, Ohms from 200ohm to 20Megs, Diodes, Continuity beeper, Capacitance from 2nF to 20uF. Plus measure hFE for PNP and NPN transisitors from 0 to 1000. Single rotary dial for unambiguous range selection. Auto-polarity 31/2 digit display. Bright yellow case so you won't lose it! EDM1111A \$118.88 inc. tax (\$103.03 ex tax)



POCKET MULTIMETER

Measures only 126mm x 70mm x 24mm yet incorporates full 31/2 digit multimeter including a continuity buzzer. Single rotary switch for fast convenient operation. Checks diodes too Measures Vdc from 200mV to 1000V, Vac 200 and 750V, Adc from 200uA to 2A, Ohms from 200ohm to 2Meg. Special 1.5V battery test range with 1mV resolution and a continuity range which beeps when resistance is below 100ohm. Bright yellow case so you can't mislay it!! EDM-70B \$64.40 inc. tax (\$55.52 ex tax).

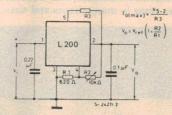
\$ 732 EX TAX

\$855 inc tax

Compact and easy to operate for hobbyists and professionals

ADJUSTABLE VOLTAGE & CURRENT REGULATOR L200C

Handles output currents up to 2A and voltages in the range 32V down to 2.85V. Thermal overload and short circuit protected. Input over-voltage protected to 60V. Only \$3.50.



Programmable voltage regulator with current limiting



P.C. BOARD ETCHER

Our bubble-etcher is ideal for prototypes and small runs. Uses a minimum of etching material ammonium persulphate - which is a clear solution so you can easily see the etching take place. Simply dissolve crystals in warm water. pour into tank and switch on air pump. The P.C. board is suspended in the etchant and the movement of the fluid washes away the dissolved copper, leaving it etched clean in a few minutes

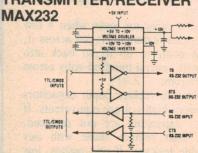
The vertical slot is only 12.5 mm wide. Two sizes suit boards up to 225 mm x 115 mm (9" x 41 \$84.00 or 300 mm x 255 mm (12" x 10") \$109.00. Comes complete with double insulated 240V air pump, hose, clamps etc

NATIONAL DATA BOOKS

Fresh stocks of latest editions, but be quick we can never get enough of them!

Logic Vol 1 1984	\$25.00	
Logic Vol 2 1984	\$25.00	
Interface, Bipolar LSI, Prog. Logic 1983	\$18.00	
Linear Supplement 1984	\$11.50	
Telecommunications 1984	\$11.50	
NSC 800™ Micro Family 1985	\$8.20	
Data Conversion/Acquisition 1984	\$20.50	

5V POWERED DUAL RS232 TRANSMITTER/RECEIVER



Yes it meets all RS232C specs but only needs a 5V supply because it has built-in converters for the +10V and -10V power supplies. Can also be used as a voltage quadrupler for input voltages up to 5.5V

Also contains 2 drivers and receivers. Uses low power CMOS. Handles 30V input level and provides a +9V output swing. Ideal for battery powered systems. \$12.96



Make your own P.C. board prototypes, signs, labels, front panels, dials etc. using the Scotchcal process and our U.V. lightbox. Fully assembled in blue plastic case. Built-in count down timer and LCD display and memory recall. Safety interlock on light switch. Minor reflectors on twin 8W U.V. lights. Effective exposure area is 230 x 115 mm. \$199.00

8.30 to 5 Monday to Friday, 8.30 to 12 Sat Mail Orders add \$5.00 to cover postal charges.

All prices INCLUDE sales tax.

Tax exemption certificates accepted if line value exceeds \$10.00.

BANKCARD, MASTERCARD, VISA, CHEQUES



GEOFF WOOD ELECTRONICS P/L (02) 427 1676

229 BURNS BAY RD (CORNER BEATRICE ST.) LANE COVE WEST N.S.W

TWX 71996 P.O. BOX 671 LANE COVE N.S.W. 2066

OR CASH CHEERFULLY ACCEPTED

specialising in electronic components for the professional and hobbyist.

MOOD

FOR CHIPS

MOOD

FOR

CHIPS

WOOD FOR CHIPS

MOOD

FOR



There are few things more useless than old electrolytics and paper capacitors.

facture or stock them any more. Shopping around may produce some, but they seem to be disappearing fast and are no longer listed in catalogs.

However, there is a solution. A 100uF 63V electrolytic is common and sells for 60 cents. If six of these are connected in series, one ends up with a 16μ F electrolytic with a 380V rating. As the capacitance of an electrolytic used in a valve radio is not critical, such a set up would work with most old radios, thus getting the restorer out of trouble. The multiple series connected electrolytic may look a bit strange and will cost \$3.60, but it's better than no electrolytic at all.

Seven and eight capacitor arrangements could also be useful, depending on the voltage rating required.

High voltage electrolytics are not the only electrolytics used in vintage radios. Some have quite low voltage ratings of 40 to 50V and are quite easily replaced with current stock.

The best advice one can offer regarding ageing capacitors in valve radios is to replace all the paper and electrolytic types. Making a clean sweep removes doubts, increases gain, improves sound clarity and eliminates many of the crackles, pops, hums and other strange noises that are common in old radios.

Resistors

Resistors, both fixed and variable, have always been part of the radio scene and there is little difference in today's resistors to those of yesteryear. There are physical differences, however, and these are in size and method of identification.

The old style resistor was quite large and the resistance value was clearly labelled. If a resistor was $1M\Omega$, it said so. None of those confusing bands of colour.

Actually, the old system seems like a good idea when you think about it. If one has to decode the colour bands to find out the resistance, why not write it in the first place?

However, this was not to be. In the years that followed, resistors where colour coded and are still that way today, although the method of colour coding has changed in recent times.

A modern resistor has three colour bands which indicate the resistance value in ohms. The first band from the end is the first figure of the reading, while the last band is the multiplier.

Colour coded resistors prior to the above sytem were based on the same colour values, but were read in a different order: body, end and dot. The body and end colours represent the first two significant digits while the dot defines the multiplier in powers of 10. If this type of resistor is not read in that order, the reading will not match up with the value.

Whilst the old system (which is common in valve radios) is known as "body, end and dot", often the dot is not a dot but a band. To add to this confusion, some resistors only have two colours: body and end — no dot. Actually, the dot is there but it can't be seen because it is the same colour as the body. In fact, it isn't even put on.

Fig.1 shows the basic scheme for the obsolete colour code. The areas marked "A" represent the body colour, area "B" the end colour, and area "C" the

dot or band. Thus, if A is red, B is violet and C is yellow, the resistor value is 270kΩ.

Establishing the value of a resistor is important for two reasons. Firstly, if a resistor is burnt out it must be replaced with one of a similar value. Secondly, old resistors are inclined to go high and they should all be checked for value with an ohmmeter. The colour code may indicate that a resistance was $0.5M\Omega$ when it was manufactured, but after 30-40 years it could rise to $1M\Omega$ or even higher. Resistors that have gone high, beyond their tolerance, should be replaced.

It is advisable to check out the resistance of each resistor in order to establish that they are of the correct value or if they have burnt out. If a resistor measures considerably less than it is supposed to, the low reading may be caused by other resistances (not necessarily resistors) in the circuit that are in parallel with the resistor being checked. If doubt exists regarding any resistor, it should be disconnected at one end and its value checked again. Checking resistances whilst they are connected into the circuit may not give a true reading.

Finally, fixed resistors should always be replaced with a resistor that it an appropriate substitute. Don't replace a one watt resistor with a 1/2 watt resistor, although the reverse is quite OK. Always replace high wattage, wire wound resistors with similar wire wound replacements.

If all the resistors in a vintage radio are checked and suspect ones replaced, then that old set has a better chance of going when it is plugged in. A few other additional checks will increase the odds even higher.

The HT choke

Most of the older valve radios have a high tension choke. The purpose of the choke is to smooth out ripple in the rectified DC which substantially reduces 50Hz mains hum. The choke can be a transformer-style component bolted to the chassis, or it can be incorporated into the loudspeaker. A loudspeaker of this type is known an an electrodynamic loudspeaker and differs from more modern speakers in that it operates with



Fig.1: the obsolete resistor colour scheme. Area "A" represents the body colour, "B" the end colour, and "C" the dot or band.

an electromagnet, not a permanent magnet. The choke or field coil energises the magnet circuit.

Why this type of loudspeaker evolved is a bit of a mystery because permanent magnet loudspeakers were already in use at the time, yet the era of the electrodynamic loudspeaker lasted nearly 20 years.

The reason for mentioning this is because every now and then the choke or the field coil of a loudspeaker burns out (usually caused by a shorted capacitor or corrosion). This, in turn, effectively cuts off the high tension supply to the anodes and screens of the valves. Therefore, a routine ohmmeter check on the choke or field coil can save a lot of time in tracking down a problem. No high tension on the anodes or screens is a good indication of choke or field coil trouble.

It is interesting that later model valve radios dispensed with chokes and substituted a cheaper high wattage resistor instead. These can also burn out.

An ohmmeter check on the primary of the loudspeaker transformer is also advisable as these can give trouble too.

While some readers may consider so many checks and replacements to be unnecessary, keep in mind that most old radios were banished to the shed decades ago because something went wrong and the set stopped working. To plug such a radio into a power point and expect it to go some 20 years later is asking a bit much. On the other hand, a couple of simple checks and a few routine replacements will bring most valve radios back to life once again.

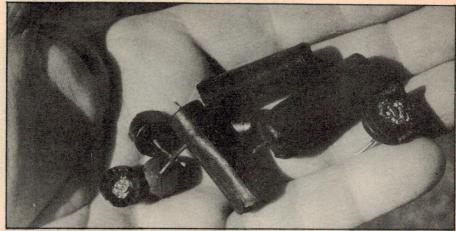
One of my own sets recently demonstrated the importance of this procedure when I chose to ignore my own advice.

This particular radio is an STC Console model with a "magic eye" tuning indicator. Having never seen a tuning indicator in operation, I switched on the set to see if it worked.

The dial lights came on which looked promising, but as no sound was forthcoming I peered into the back of the set to see if there was anything abnormal. Abnormal! The anodes of the rectifier valve were glowing red hot!

As you can well imagine, there was great haste to turn the set off and, as yet, the trouble has not been investigated. However, I'm sure it will be a case of replacing ALL the paper capacitors and electrolytics when the time comes to restore it.

So take my advice — plugging in an unchecked valve radio is asking for trouble.



Paper capacitors of AWA manufacture often split or blow their ends off when they short circuit.

Although restoring valve radios is an interesting and rewarding hobby, perhaps this article should close with a word of warning.

Always keep in mind that some of the voltages beneath the chassis of a valve radio are lethal and could result in some unsuspecting restorer's early demise. In other words: be careful or you may end up dead! There are even a few AC/DC sets around with live chassis — so beware!

In fact, it is a good idea to steer well clear of transformerless sets unless you know exactly what you are doing.

Remember, always switch off the power, pull the cord and discharge the electrolytics before working on a set. Simply switching off isn't good enough in some instances.

Normally, an electrolytic capacitor discharges itself within a few seconds of switching off, but if the high tension choke (or loudspeaker field coil) is burnt out, then there is nowhere for the charge to go until a path is provided for it to follow. As such, a capacitor could have a potential of around 400V, so it is wise to treat it with respect.

An insulated clip lead fitted with a series $10k\Omega$ 5W resistor can be used to discharge the electrolytics. Do not directly short the capacitor terminals together with a screwdriver or clip lead — you could fuse the internal wires running to the terminals of the capacitor if you do.

This article on valve radio restoration has concentrated mainly on repairs of an electronic nature, but there are other problems facing the vintage radio restorer. Some radio components, such as dials, desperately need mechanical repairs, while the cabinets also require attention. More about such things in the next article.



Vermin, namely rats and mice, can do considerable damage to old radio components. A thorough checkout before plugging the set into the mains will detect such hazards.

Avocet turns an ordinary PC into an extraordinary development system. And saves you \$20,000 in the process.

Now, there's a way to see all your best microprocessor designs take root, easily and effectively. Avocet cross-assemblers, simulators,

THE AVOCET CROSS-ASSEMBLER FAMILY.

AVMAC Macro Cross-Assem	bler
MSDOS™, PCDOS™	\$349
VAX™/UNIX™	
XASM Cross-Assembler	

CP/M™-80, CP/M-86\$250 Target Microprocessors Supported:

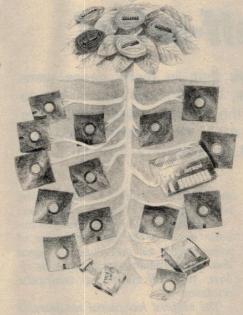
6804 6502/65C02 Z8 6805 6800/01,6301 Z80 6809 NEC 7500 68HC11 1802/1805 8085 HD64180 8048/8041 COP400 68020 8051 F8/3870 68000/68010

New AVMAC Macro Cross-assemblers offer these important features: Powerful macro facility, relocatable code, linker and librarian, cross-reference by line and procedure, plain English error messages and much more.

™ Signifies manufacturer's trademark

emulators and EPROM programmers turn your personal computer into a sophisticated development system. No more waiting for the continually overloaded mainframe. Or, wondering how to pay for a \$20,000 dedicated development system. Avocet products save time and money, and provide the most flexible development system available.

Avocet allows you to develop software for practically any microprocessor without switching development systems. And equally important, Avocet development tools are easy to install and easy to use. We provide you with everything you need to develop microprocessor software, from data entry through assembly, debugging and final EPROMs.



Now "debug" on your PC.

Avocet has realistic answers for users who want low cost

debugging capability.
Until now, engineers
have been very much
on their own in the
area of testing. But
now Avocet simulators

and emulators virtually eliminate the frustrating and often costly "crash and burn" method.

New AVSIM family of full screen simulators.

Avocet's new software simulator/ debuggers let you test your code in a crashproof, interactive environment, without additional hardware. Your PC's screen becomes a "window" into the simulated target CPU. Extensive break point, I/O, and interrupt facilities make AVSIM a truly useful development tool. Price \$299.

New TRICE in-circuit emulator.

At last, an affordable in-circuit

emulator! With the self-powered TRICE, you can examine target memory and register, set break points, single-step, trace and more; TRICE recognizes 34 different commands. Its serial interface lets you control emulation and download code from your terminal or PC. Priced from **US \$595**

AVPROM programmers work with any PC.

The AVPROMs program over 37 different devices, including EPROMs through 27512, CMOS and E² PROMS, and MPU/EPROM combos, using fast "adaptive" algorithms. Intelligent, self-contained units work with any personal computer.

Made to order

AVOCET software systems are manufactured in Melbourne. We turn your order around in just 24 hours.

Just call, toll free.

(008) 334 839

(in Melbourne 481 0155) and we'll rush your order, send you more information, give you great technical backup, or, introduce you to our dealer nearest you.

AVOCET SYSTEMS PTY LTD PO Box 1066, North Fitzroy, Vic, 3068. Phone 481 0155, Fax 489 4646, Telex 151675





Audiophiles are not all half-wits!

Faced with quite a few letters that, in many cases were written during the holiday break, I am somewhat at a loss to know where to begin. Perhaps the logical starting point is one from a reader in Macgregor, ACT, who "blew his top" on Christmas eve when he saw Leo Simpson's editorial in the December issue.

As will be evident from the letter, I apparently compounded his black mood by remarks in the "Forum" column of the same issue, which tended to put the damper on claims dear to the heart of audiophiles in the "golden ear" set.

With some abbreviation to conserve space, the letter runs as follows:

Having read the editorial by Leo Simpson in the December issue, I am appalled at the arrogance and the cavalier attitude displayed in his "truth about turntables" diatribe.

First, he (conveniently?) misrepresents the view of analog audiophiles, who have NEVER claimed turntable superiority in the areas of surface noise, feedback and other related afflictions; indeed, it is the very superiority of CD in these areas which makes its musical inferiority so frustrating!

Fair go - we're not all half-wits!

The area of audiophile contention concerns the audible effects of digital processing on the musical signal, particularly at high frequencies, which affect the harmonic content and spatial information.

Surely I do not need to explain all that here. It has been the topic of intensive investigation and debate for several years in the better specialist (ie, serious) audio publications — with considerably more competence in the field than an electronics magazine.

Elsewhere, in the same issue ("Forum") we find the implication that the enthusiast who spends large sums of

money on "exotic" interconnecting cables is living in a land of self-delusion.

Rather than becoming involved in another argument on the inadequacy of some current test procedures, I suggest that, if you cannot hear any of these effects, your hifi system has inadequate resolution.

The editorial has caused considerable offence among local audio enthusiasts. Calling people stupid is hardly an objective comment. Calling people liars because they hold a viewpoint different from your own is an intolerable abuse of a privileged editorial position. I am diverting my magazine expenditure elsewhere.

My guess, on reading M.B.'s letter, is that he has lost patience, not just with Leo Simpson but with technical types generally who question his firmly held beliefs and, by implication, further investment in analog phono equipment. He was especially incensed, however, by what he regards as Leo Simpson's "arrogance and cavalier attitude".

On the other hand, I would interpret Leo's remarks as an indication that he had become no less exasperated by statements orchestrated by entrenched audiophile interests, which he judged to be inspired more by commercial expedience than technical accuracy. Perhaps Leo's main "sin" was that he expressed in such a forthright manner a viewpoint currently shared by most technically qualified audio professionals.

I say this because, over the years, I have found very little sympathy amongst

academics and audio engineers for many way-out claims promulgated for — and by — the "golden-ear" fraternity. They tend to be dismissed in much the same way as the claims of the flat-earth group!

At the same time, I should perhaps make the point that technical qualifications and musically educated ears are

not mutually exclusive.

The letter in close-up

I have no wish to get involved in a slanging match with M.B. but I do have some difficulty with the contents of his letter.

Analog audiophiles, he says, have NEVER (his emphasis) claimed turntable superiority in the areas of surface noise, feedback and other related afflications. I don't see how they could and I doubt that Leo intended to imply that they did. They tend, simply, to make ambit claims which (conveniently?) omit any reference to the abovementioned shortcomings.

I could quote, for example, from the articles on up-market phono players already mentioned in the February issue (David Frith, "The Guide", Sydney Morning Herald, Oct. 13 & 20):

"Most hifi specialists still insist that a well set-up analog LP system sounds bet-

ter than the digital system".

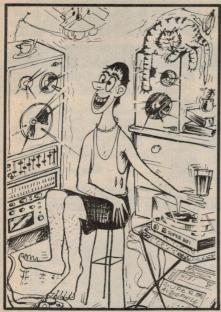
"Any of the turntables mentioned in this column when properly set up with a quality cartridge, is capable of outperforming a compact disc player".

It so happens that the two articles appeared about the time Leo Simpson would have written his December editorial. Whether or not they helped to provoke it I wouldn't know but they apparently managed to provoke quite a few other SMH readers. David Frith mentions in the January 12 Pink Guide that he had copped a lot of flak because of what he had written. I quote:

"For days the phone didn't stop ringing, and bitter indeed were the denunciations from the CD fans . . . You're in the turntable manufacturers' pocket, &c".

He goes on to say that he doesn't retreat for one minute from the views previously expressed, but he does restate them in the following terms:

"A top quality turntable, well set up with a good quality cartridge and tonearm, playing an LP in good condition, can certainly extract finer musical detail than most CD players. If you doubt this, walk into any good hifi store and ask for a demonstration of one of the abovementioned turntables".



Definitely not a half-wit audiophile!

The modified statement parallels M.B.'s reference to the "musical inferiority" of the CD system which he attributes, in turn, to "the audible effects of digital processing on the musical signal, particularly the higher frequencies, which affect harmonic content and spatial information".

I find this very interesting because, from small beginnings in the late '70s, virtually all performances for CD, LP and tape alike are now recorded and processed on digital mastering equipment.

Curiously, this seems not to have rated a mention either by M.B. or any of the suppliers interviewed by David Frith. There is no hint that digitally mastered LPs are in any way suspect!

You can take your pick of the questions which would seem legitimately to follow:

- Why would the world audio industry, employing an army of musically informed engineers and producers, spend a fortune re-equipping with digital equipment, if they had reason to believe that it was likely to prejudice the intrinsic musical quality of all future recordings? Are they the real half-wits?
- If it is assumed that digital processing, per se, does compromise musical quality, as per M.B.'s letter, are we to believe that digitally mastered LPs somehow escape "musical inferiority" provided they are replayed on prestige analog equipment?
- If digitally mastered LPs are not musically inferior when played back on prestige analog equipment, is M.B.'s real quarrel with digital processing as employed in the CD format? If so,

where lies the problem?

If there is a convincing positive answer to that last question, I have yet to see it. Mind you, if I were in M.B.'s shoes, I could contrive a suitably mischievous theory — without any known basis in fact, or even a conviction that there is a situation that needs to be explained!

How does this sound?

While the sampling parameters of hifi digital systems are all much of a muchness, the more ambitious record/playback equipment uses multiple tracks for each channel, with automatic switching in the event of a fault. (See DASH format, Nov. 1986 issue, p.78, col.1).

The CD system, however, has only one data stream to serve both channels, backed up by highly effective error detection circuitry capable of correcting or concealing disontinuities in the data stream that might otherwise be heard as clicks or plops.

Could it be that CD technology relies too heavily on correction circuitry, particularly in the case of discs and/or players with more than their fair share of data stream errors?

Could it be that, in the process of effectively concealing an excessive number of errors, it also conceals an excessive quota of high frequency signal information?

Let me repeat: I didn't read this anywhere; I dreamed it up for the occasion, but it's no more way-out than some other notions dreamed up by audiophile theorists.

And that brings me to the next point in M.B.'s letter.

"Intensive investigation"

He assumes that the alleged audible ill-effects of digital processing are so well documented as not to warrant further explanation. I quote:

"It has been the subject of intensive investigation and debate for several years in the better specialist (ie. serious) audio publications: publications with considerably more competance in the field than an electronics magazine."

Debate? Yes. Investigation? That's a matter of opinion!

My mind goes back to the late '70's when we began reviewing the first digitally mastered LPs to reach Australia. We were impressed and we said so. Many readers bought pressings and liked what they heard. Others were dubious about the whole idea, especially when that view was encouraged by some (not all!) of the so-called "specialist" audio magazines.

Some record and equipment vendors were so keen for me to get the anti-digital message that they sent me endless photostat copies of articles, clippings and circulars containing statements that were unsupported and, I suspect, unsupportable.

That has long been the problem for those "better (ie. serious) audio publications". They latch on to speculative ideas, which gain substance through literary feedback, until they are accepted as fact — often without a shred of objective evidence.

You may possibly have noticed a letter from R.S. of Lae, PNG (Forum, Feb) which made this very point. I

quote:

"You must also have been amazed by the observations and reviews published in certain British audio magazines. In the period from the introduction of CD in 1983 to late 1984 there was a torrent of emotional opinion but, in the reviews, nary a measurement".

There is most certainly a place for speculation in hifi sound reproduction and for subjective reaction but, without reasonable checks or balances by way of basic theory or objective evidence, it/they can get completely out of hand. (Sotto voce): They can also be exploited!

"To be or not to be ..."

Towards the end of his letter, M.B. criticises "Forum" in the December issue. In it, I referred to the fact that, in subjective A-B comparison tests, it was essential to ensure that the respective signals were at the same sound pressure level, otherwise there was a risk that the louder signal would be adjudged the better of the two.

I mentioned a recent finding that a difference margin of even 0.2dB was unacceptable. This was an interesting figure, because calculation showed it to be somewhat less than the difference in level to be expected between standard and super low-loss loudspeaker cables.

Unless it was taken into account when setting up a subjective test, the low-loss cables could be given the verdict simply because the marginal difference in loudness created an impression of better sound. As such, I suggested that it would be "a rather expensive alternative to an almost imperceptible clockwise nudge to the volume control".

To the best of my knowledge, that is a supportable statement. M.B. can reject it if he wants to; it's his money.

In the matter of syndromes, I too have been misrepresented but I can sug-

SYDNEY-MELBOURNE-BRISBANE

COMM. RECEIVERS & SCANNERS



NEW BRILLIANT NRD 525 COMM. RECEIVER FROM JRC

The new NRD 525 combines advanced performance and construction not seen on any other receiver

Features — * Wide freq. range — HF 90 KHz to 39 MHz and optional VHF/UHF band * 200 channels memory * Scan reception * Teletype reception (optional) * Direct access tuning * Wide dyhnamic range * Clock timer * Interface with PC

Simply The Best! only \$2299



NEW — ANTENNA TUNER WITH LOW NOISE PREAMPLIFIER



ETP-1 is an ideal accessory for all short wave receivers in the HF band. It tremendously improves the reception of

ICOM IC-R71A MOST



ICOM IC-R71A commercial receiver, one of the most popular receivers among short wave listeners. With 32 memories, keyboard entry, extremely high stability and superior performance makes R71A a highly respected

\$1549

NEW KENWOOD R5000

Just Released \$1175



This latest addition to the respected Kenwood range of receivers is really unique. With 100 memories, keyboard entry, superb interference reduction and absolutely latest technology makes R5000 the best value on the market.

UNIQUE IC-R7000 \$1879



ICOM IC-R7000 is a top groove sanner, with 99 n keyboard entry and many other features making IC-R7000

CODE CONVERTERS

For short wave listeners

In CW-RTTY-ASCII-AMTOR and FAX Mode! To monitor marine, police, Interpol, weather, embassy,

To monitor marine, police, interpoi, weather, embassy, amateur and press services!

CD 670: High performance decoder for CW, RTTY, AMTOR (SITOR CCIR 476) and ASCII

CWR 860: CW-RTTY-ASCII-TOR-AMTOR Converter 4849

M 800 FAX: Unique new radio Fax Converter - Ideal for marine, weather maps, professional, commercial \$1099

M 6000: A unique highly professional decoder that does expendition.

TEST INSTRUMENTS

NEW

KIKUSUI 60 MHz-TRIPLE TRACE OSCILLOSCOPE - COS5060



Total Performance, multi-purpose, 3CH-Multi Trace. Dome-mesh type 12KV P.D.A. CRT. A and B Alternate sweep. Hold-Off function. VERT MODE trigger function. Energy-Saving design (PAT. Pending). Designed for Laboratory, Production Iline, Maintenance and Field service use.

ONLY \$2660.00

INCLUDES 2 HIGH QUALITY PROBES

NEW GW 20 MHz, DUAL TRACE OSCILLOSCOPE

A heavy duty and accurate scope for

service as well as production use.
Features include • Wide freq. bandwidth
• Optimal sensitivity • Extremely bright
display • Auto trigger level • Variable hold off • Alternate triggering • DC trigger coupling.

Includes 2 high quality probes



10 MHz SINGLE CHANNEL CRO

GOS-3310

- bmV/div sensitivity
 Light & compact
 Easy to operate
 Low cost
 High performance
 TV sync, mode
 Ideal for education,
- hobby and service work

\$454

5MHZ OSCILLOSCOPE GOS-955

- · Low cost
- High performance
 User friendly
 10mV/div Sensitivity
- Ideal for education, hobby



- GOS522

FREQUENCY COUNTERS

le range of Lab-quality freq. counters at a

DIGITAL MULTIMETERS

GFC 8010F (120 MHz) \$392 GFC 8055F (550 MHz) \$669 GFC-8100G (16 Hz)

- Microprocessor controlled
- ignosis routine
- \$839

- **GUC-2010 UNIVERSAL COUNTER**

GDM-8135T

\$373

High Voltage 1200V, 20A
 Auto Zero Circuit
 Range Protection

Diode Test Function

\$568

Frequency, period, totalize, freq. ratio and time interval

CHECK OUR RANGE OF PROFESSIONAL

CB RADIO

Emtron Ace - Australia's most popular 40 CH general purpose hand held **UHF CB transceiver**

- Commercial & Professional Work Factory Management Hunting and Fishing Building and Road Construction

- Boating
 Farming and Pastoral
 Crowd Control
- Construction Work General Sport
- Personal Communication

Security
Business
Mobile and Portable \$599

UNIDEN UNIDEN
PC33 — 27 MHz AM
AX144 — 27 MHz AM/SSB
PC122 — 27 MHz AM/SSB
Sundowner UHF CB mobile
Sundowner UHF CB hand held \$599 ELECTROPHONE

VISIT OUR STORES FOR THE MOST COMPREHENSIVE SELECTION OF RADIO COMMUNICATION EQUIPMENT IN AUSTRALIA — COMMERCIAL, AMATEUR AND CB. THERE IS NO STORE LIKE EMTRONICS!

ANTENNAS:

Stationmaster, 27 MHz base TEIIF3J, 27 MHz ele beam DA300, 25 MHz to 1.3 GHz scanner ant. ARA500 Active scanner ant. AH7000 Scanner discone **ANTENNA ROTATORS:**

We stock all popular antenna rotators: KR 400 medium duty KR400RC medium duty 360° dial KR600RC medium to heavy duty DR2000RC heavy duty Create RC5-3 heavy duty Daiwa MR 750 medium to heavy

CORRESPONDENCE:

REGULATED POWER SUPPLIES

We stock Australia's largest selection of high quality lated power supplies

PS120M — 3-15V, 12A \$299 PS310M — 3-14.6V, 31A \$549 ALINCO: EP-570 — 13.8V, 6A EP-1510 — 13.8V, 15A EP-2510 — 13.8V, 25A EP-3030 — 13.8V, 25A WELZ:

RS3050 — 3-15V, 25A RS650 — 13 8V 6A

e

TX472 — UHF CB mobile TX475 — UHF CB hand-held

ICOM IC40 — UHF CB hand-held



\$292

Escort FDM 1111A DIGITAL MULTIMETER



LCR METER Escort ELC 123

4 3

ANALOGUE MUILTIMETERS — SOLID PERFORMER

RANGES

BUILT IN BUZZER ELC-120

3½ digit LCD display

Wide measuring ranges
3 inputs: hi, lo & guard

• 6 Functions (AC/DC) Voltag &

rrend Resistance & Diode 3½ Digit

High resolution, 0.1mV,0.1uf

High accuracy 0.1%

- High accuracy in measuring
 One rotary range switch allows fast and convenient operation
 Diode check DC/AC, 10A
- Instant continuity check Low batter indication 200 hrs long battery life Overload protection on all

its: hi. lo & guard

tance: 200pF-200µF, 7

ranges
0.1pF max resolution, 1%.
Inductance: 2mH-200H, 6 ranges
0.1μH max resolution, 2%.
Resistance: 20Ω-20mΩ, 7 ranges

10mΩ max resolution.

spare fuse. Instructio

Accessories included: Test clips

\$264



EDM-1105

GDM 8145

(GDM 8045)

3½ digits LCD display
 Diode testing

High accuracy 0.03%
High range — 1200V, 20A

Auto zero
 True RMS \$500

O Unde testing

V DC 0.2-1000 V, 5 ranges
100 μV max resolution. 0.8%
V AC 0.2-750 V, 5 ranges
100 μV max resolution. 1.5%
A DC 2 mA-10 A, 5 ranges
1 μΑ max resolution. 1.25%
A AC 2 mA-10 A, 5 ranges
1 μΑ max resolution. 2%
Ohm 200 Ω - 20 MΩ, 6 ranges
0.1 max resolution 2%
Auto 2 mA-10 A, 5 ranges
0.1 max resolution 1.0%
Auto 2 mA-10 A, 5 ranges
1 μΑ max resolution 1.0%
Auto 2 mA-10 A, 5 ranges
0.1 max resolution 1.0%
Auto 2 mA-10 A, 5 ranges
0.1 max resolution 1.0%
Auto 2 mA-10 A, 5 ranges
0.1 max resolution 1.0%
Auto 2 mA-10 A, 5 ranges
0.1 max resolution 1.0%

\$91

ANALOGUE MULTIMETERS SOLID PERFORMER — BUI - BUILT IN BUZZER



ST-380TR

- Transistor checker
 Mirror scale
 Fuse & diode protection
 20kΩ/V sensitivity

V DC: 0-0.1, 0.5, 2.5, 10, 50 V DC: 0—0.1, 0.5, 2.5, 10, 50 250, 100 V AC: 0—10, 50, 250, 1000 A DC: 0—50 µ. 2.5 m. 25 m. 25 m. Ohm: Rx1, Rx10, Rx100, Rx1k. dB — 10—50 dB Continuity buzzer. Dim: 106 x 149 x 55 mim.

WELCOME

\$36

MAIL ORDERS

BOX K21, HAYMARKET, NSW.2000

92-94 Wentworth Ave, Sydney NSW. 2000. TLX:AA73990 P.O. Box K21 Haymarket, NSW. 2000. Ph: (02) 211 0988 FAX: (02) 281 1508

NSW & HEAD OFFICE:

Retail Division of EMONA ELECTRONICS P/L VICTORIA:

288-294 Queen St, Melbourne Vic. 3000. (Entrance from Lt. Lonsdale St) Ph: (03) 67 8551 or 670 0330 FAX: (03) 670 0671

QUEENSLAND:

416 Logan Road, Stones Corner Qld. 4120. TLX: 144696 Ph: (07) 394 2555 FAX: (07) 397 3531

FORUM - continued -

gest a compromise proposition to which I'd be willing to subscribe:

If you think that you can hear it, It may be worth a shout; But until it's been measured There'll always be a doubt!

From West Malaysia

A reader, MOYK, from West Malaysia, whom I would take to be a professional engineer, also comments on the December Forum. However, he appears to have completely misread my remarks about special quality audio cables.

He says: "The concept you had was that a low loss cable will increase the output signal level arriving at the input of an amplifier which in return contributes to better sound."

In fact, the article had primarily to do with loudspeaker cables. The key paragraph in column 2 explicitly says:

"Calculations suggest that ordinary loudspeaker cables typically introduce a loss in level of about one quarter of a decibel in an 8-ohm circuit compared with nominally loss-free heavy duty cables."

The point being made was that in a subjective A-B test situation, using a common amplifier and common loud-speakers with inter-cable switching, the difference in sound pressure level could amount to 0.25dB or more — a totally unacceptable figure according to DLC Design Inc.

Small-signal amplifier input cables were mentioned once only, in column 3, in an entirely separate context.

While at odds over cables, the same correspondent "absolutely" supports my observations in the same issue on the subject of valve amplifiers. He concedes that valves have a "softer" overload characteristic than transistors but says that, in other respects, "valve amplifiers are no match for a modern, state-of-theart solid-state amplifier."

Subjective frequency response

Getting back to the original theme, the stated subjective reaction to a loudness increment has been accepted as a truism worldwide and for decades. Curiously, however, I cannot recall ever having seen it explained in detail. To some degree, a least, it would appear to have its roots in the Fletcher-Munson equal loudness contours (Bell Laboratories, 1933) and subsequent parallel re-

search, including work by Pollack using narrow band noise in lieu of discrete tones.

The curves all indicate that, at very low sound pressure levels (faint sound), human hearing is most sensitive in the 2-4kHz region. For equal loudness at other frequencies, the SPL (sound pressure level) needs to be increased by as much as 65dB as the frequency diminishes towards 30Hz. For the higher frequencies, the SPL needs to be increased by up to 20dB.

As the sound source becomes louder, the disparity between low/medium/high frequencies diminishes progressively, with aural response becoming reasonably uniform overall at sound pressure levels above about 80dB.

That it is essentially an acoustic/aural effect can be illustrated by reference to an outdoor brass band concert. From a distance, the sound is faint and "thin" but, as one walks towards the rotunda, the low frequencies and the higher order harmonics become progressively more evident until, close by, normal overall sonic balance is realised.

In the context of hifi sound systems, technical writers have commonly made the point that the most natural listening conditions obtain when the volume control is so adjusted that the sound pressure level at the listener's ears is similar to what it would be if he/she were seated in the audience at the original performance. Assuming that the amplifier chain has a substantially flat response, the subjective balance of the original and reproduced sound should then be similar.

If, on the other hand, the SPL at the listener's ears is substantially below optimum, the bass and to a lesser extent the upper treble will be subjectively weaker. Conversely, an unduly high level can have the reverse effect, with male voices in particular tending to sound unnaturally heavy.

The subjective frequency imbalance which results from an inappropriate SPL at the listener's ears has been described over the years in technical literature as "scale distortion"; eg, "Radiotron Designer's Handbook" (F. Langford Smith, 3rd. Ed., 1940); "Audio Cyclopedia" (H.M. Tremaine, 2nd. Ed., 1975). In his "High Fidelity Pocket Book" (Newnes, 1962), W.E. Pannet uses the term "volume distortion" to mean the same thing.

Scale (or volume) distortion becomes

a fact of life in domestic listening situations, when the volume level needs to be severely restricted out of consideration for other members of the household

To help compensate for the subjectively less vital sound, amplifiers often include loudness compensation circuitry, either integral with the volume control or controlled by a separate switch. Its purpose is to boost the bass response and to a lesser extent the treble whenever the equipment is operating, of necessity, at an unnaturally low volume level.

A-B test situations

Logically, any discrepancy in the SPL of two signals being subjectively compared must be responsible for some difference in the subjective bass and treble response — therefore in the potential quality of the two signals.

On the other hand, it could be argued that with an SPL discrepancy diminishing to a small fraction of a decibel, subjective frequency variations of the Fletcher-Munson kind would be microscopic

Perhaps the most we can say is that any difference in frequency balance that might be picked up by an astute observer will be to the advantage of the louder signal.

Over and above that, the louder signal will have an advantage in terms of ambient noise, especially in respect to the fainter, more delicate stanzas. By ambient I am referring to the noise in the listening room and the physiological noise in the listener's own ears — especially where tinnitus may be present.

And, finally, there is the simple matter of magnitude of the sound, or the tendency for a larger sound to be more dominant, more arresting than a smaller one.

These statements don't sound very decisive? I agree. Under ordinary listening conditions a dB this way or that wouldn't matter two hoots. But remember that, under A-B test conditions, things are set up to expose the smallest differences. No less to the point, the participants are often under psychological pressure to record definitive verdicts—hopefully without inventing them!

I happen to know this from first-hand experience, having sat through quite a few such sessions, here and overseas, when my ears were younger and more acute.

Come to think of it: if you're on the lookout for an audio research project, this whole area could be worth considering.

BOOKS -**SAVE 50%**

THE LOCAL AREA **NETWORK BOOK**

Defines and discusses localised computer networks. You'll learn how networks developed and what networks can do; what's necessary in components, techniques, standards and protocols; how some LAN products work, and how real LANs operate, how to plan a network from scratch and much more.

128 pages. Cat. BS-0718 WAS \$15.95

ONLY \$7.98

THE VIDEO PRODUCTION GUIDE

All that you ever wanted to know about professional video production but were afraid to ask! Divided into 4 parts preproduction, production, post production plus other important topics i.e. editing - you are guided slowly thru each phase of the art. WAS Approx 400 pages. Cat. BS-0727

\$39.95

NOW \$19.98

ATARI GAMES & RECREATIONS

For beginners and advanced programmers as well.Learn to program in BASIC while you work with your own Atari 400 or 800. Play many challenging educational games and learn to create programs of your own

338 pages Cat. BS-0656 WAS \$23.95 NOW \$11.98

HOW TO MICROCOMPUTERISE YOUR BUSINESS

This book takes the mystery and technicality out of computers - making your decisions about computerisation as rational and intelligent as any other business decision you make. Explains how computers can help you run a more efficient, more profitable busines

182 pages. Cat. BS-0680 WAS \$15.95

ONLY \$7.98

INTRODUCTION TO

THE NEW TECHNOLOGY

144 page book describing subjects such as teleshopping, telebanking, electronic mail and many more forms of electronic communication. There is also a section on

lasers Cat. BU-1200

\$9.95

Designed for the engineer or technician wishing to improve his knowledge of cable TV. Component testing, troubleshooting, noise reduction, and system failure are discussed. Contains valuable information on the relatively new areas of fibreoptics and communications satellites

392 pages. Cat. BS-0560 WAS \$21.00

ONLY \$10.50 MICROCOMPUTER

FOR BUSINESS **APPLICATIONS**

This book describes different types of micros, highlights pitfalls and explains computer related terms. If you are the potential buyer of a business computer system, this booko will prove invaluable in helping you select the best system. A must to read before "plunging". 256 pages Cat. BS-0602 WAS \$15.95

ONLY \$7.98

INTRODUCING THE APPLE MACINTOSH

Introduces you to the design philosophy and physical structure of the Mac, and explores its displays, keyboard, mouse, software and accessories. Covers graphics, word processing, spreadsheets, BASIC and windowing and discusses how the Mac fits into an office system

192 pages. Cat. BS-0714

WAS \$21.95 **ONLY \$10.98**

HOW TO READ SCHEMATICS

Edition

Explains circuit components and how they are represented in schematics. Then explains common circuit configurations such as emitter-followers, basic common circuits, etc. Essential if you want to understand schematics

Cat. BS-0730 | WAS \$27.50

NOW \$13.75

VIDEO **FUNDAMENTALS**

This book is for all who want to learn about video taping. Topics covered include: How a recorder works; How to choose a VCR; How to playback videotapes; Sound advice; How to add a camera; Lighting techniques; How to make your own videotapes; How to add a second VCR; How to take care of your equipment & Video formats.

186 pages Cat. BS-0646

WAS \$22.95

ONLY \$11.50



TO CELEBRATE the RELEASE of our BRAND **NEW CATALOGUE** we have SLASHED the PRICES of many of our BEST SELLERS - but ONLY for APRIL, SO BE QUICK

NEW 1987 CATALOGUE

The new Jaycar 114 page Engineering Catalogue was released last month in Electronics Australia and Electronics Today.

If you don't have one yet there are two things you can do.

(1) Call in to any one of our retail showrooms and pick one up, they are only \$1.00.

(2) Send \$1.00 plus \$1.00 for P&P to Jaycar Electronics, P.O. Box 185 Concord 2137 and we'll post you a copy

YOU WON"

SORRY

TO-3 HEATSINK Special Usually \$1.95

We have made a bulk purchase of TO-3 minifin neatsinks. Size 38 x 38 x 26mm(high) Cat. HH-8509

\$1.00

APRIL ONLY 1-9 \$1.25 10-99 \$1.10

100 up

TURN YOUR SURPLUS STOCK INTO CASH!

Jaycar will purchase your surplus stocks of components and equipment. We are continually on the lookout for sources of prime quality merchandise.

CALL GARY JOHNSTON OR BRUCE **ROUTLEY NOW ON (02) 747 2022**

lant

E

A

S

T

E

SHOWBAG

Back again for the 6th year! Once again we have a JUMBO bag weighing an average of 2.5kg! Each bag is slightly different but certainly contains an unbelievable assortment of electronic components, electronic hardware and much, much more!

We are certain that you will be absolutely delighted with this incredible addition to your junk box!

your junk box!
Cat. XB-9000 \$12.95
Quantities strictly limited - personal shoppers only due to heavy weight.

EVER POPULAR TWEETY PIE DISCOUNTED

This incredibly little piezo screamer measures 57(L) x 33(H) emits a 116dB wail. It's deafening! As used in the screamer car alarm kit. Usually

APRIL ONLY \$15.00

\$16.95 SAVE \$1.95



GENUINE CANNON

At 1812 Prices

SAVE ON CANNON CONNECTORS

Description	Cat. No	Normally	Special	10 UP
3 pin Chassis Male	PP-1020	\$4.25	\$3.25	\$3.00
3 pin Line Male	PP-1024	\$5.25	\$4.00	\$3.75
3 pin Chassis Female	PS-1030	\$5.95	\$4.75	\$4.50
3 pin Line Female	PS-1032	\$5.50	\$4.50	\$4.25
Mo also bayo a guantity of	Cannon calcured beats	Available to Dec	1 M/L 4 - M-II	DI

and Green. Not all colours available. NORMALLY 90¢ each - LAST FEW at 40¢ each.





ETI 684 INTELLIGENT MODEM

Ref: ETI most of 1986

This is a full blown auto dial - auto answer - full duplex intelligent modem.

The Jaycar kit for the complete project comes as two

components viz: Cat. KE-4715 Power Supply Cat. KE-4716 \$ 49.95

BUY BOTH FOR \$379.00 SAVE ALMOST \$50.00

For full specifications see the Jaycar 1987 Catalogue

CONCORD OPEN SATURD



METEX BARGAIN

10 AMP DIGITAL

MULTIMETER +

TRANSISTOR

TESTER +

CAPACITANCE

METER

supplied# LED and buzzer continuity test

long term stability # CMOS logic# 1,000 -

2,000 hours battery life # fuse protection

Complete with battery and spare fuse

floating decimal point # auto polarity

SAVE \$20.00 APRIL ONLY

ONLY \$109.00

THE JAYCAR 1987 CATALOGUE

LOOK AT THESE FEATURES:

0.5" high digits # high quality probes

precision thin film resistors used for

WORLD CLASS ADCOLA SOLDERING DESOLDERING STATION

See our new catalogue for full details POWER CONTROLLER Cat. TS-1475

(no iron or desoiderer supplied)

\$139.50

40 WATT SOLDERING PENCIL CT-6 Cat. TS-1478

\$39.95

80 WATT SOLDERING PENCIL CT-7 Cat. TS-1480

\$42.50

BONUS: Purchase this soldering station in April and receive 2 rolls of solder FREE.



DESOLDERING TOOL Cat. TS-1476

\$59.95

MADE IN AUSTRALIA

HEAR ANSSON VIDEO ENHANCER

D

impact resistant case FOR FULL SPECS SEE

JAYCAR JVE-1 VIDEO **DETAIL ENHANCER**

Connects between 2 VCRs to improve the quality of a recording of an original tape. 625 line PAL-D 50 frame unit. Can be used as a distribution amplifier. Cat. AV-6501

FULL DETAILS IN 1987 CATALOGUE

APRIL SPECIAL FREE PLUGPACK WORTH

\$12.95 (Cat. MP-3020)



ONLY \$79.95

CHO CHAIN

Also known as a keyfinder. Put it on your keyring and when you want your keys just whistle and it will whistle back to you. These were selling for as much as \$15. We have a limited quantity to clear out for only \$3.95 each. This is less than half what you would

expect to pay. Cat. XM-0900

\$3.95 each

WE'RE OVERSTOCKED **MAGNAVOX** 8MV-003

8/30 replacement

Update your 8/30 speaker boxes today and turn them from 30 watt rms system speakers into a 120 watt system!

These are direct replacements and fit into the 8/30 cutouts.

Resonant frequency 31Hz; range from fo to 4kHz. Sensitivity 95dB.

Cat. CW-2110

NORMALLY \$89.50

SAVE \$20.00 ONLY \$69.50 ea



LIGHT DEPENDENT

RESISTORS Quality Philips brand. \$8.50 ea 10+ \$8 ea Epoxy housed, vertical

or horizontal mount. Dark resistance min 10M ohm

Light resistance 30-300 ohms Cat. RD-3480



AUSTRALIAN MADE MAGAZINE BINDER

NOW IN STOCK!

Re-designed to really in comfort. Uses holes instead of slots to hold your mags. Will easily hold 12 magazines but can accommodate more SEE OUR NEW CATALOGUE FOR MORE DETAILS Cat. BB-7000

\$7.95 ea 10+ \$7.50 ea

FULL SPECS IN CATALOGUE

ALARM SYSTEM OWNERS We have a small quantity of components left to suit the Bonax Alarm

This is an ideal time to add that other siren. All you need do is plug it in

ATTENTION * *

BONAX WIRELESS

the mains and mount it somewhere. Normally \$99, we have 11 only at \$50 each. We also have two control panels reduced from \$299 to \$100. This stock is available only through Mail Orders. Phone (02) 747 1888

SOLDER REEL 200 gram reel. 1mm universal gauge. Suitable for all types of electronic

Resin cored and includes bit saving additive.

NORMALLY \$7.95 reel

\$6.50 reel \$5.50 ea 5 reels SAVE UP TO \$2.45

SOLAR POWER 150 EXPERIMENTS

This experimenters kit enables the enquirer to verify many of the fundamental physical aspects of solar energy. The 150 experiments include: solar furnace, stroboscope, electroplating, electronic thermometer, solar powered fan, etc. Includes all necessary components for all experiments. Does not require batteries. Gift boxed - measures 410(W) x 305(D) x 85(H)mm. For ages 10+. Cat. K.J-6692

USUALLY \$39.95 NOW ONLY \$29.95 **SAVE \$10.00**



SAVE ALMOST 50%

ALARM STICKERS

Large 125mm x 75mm Suitable for house, factory, caravan, etc. Will stick on the outside, i.e. sticky on the

Cat. LA-5102

10A

NORMALLY \$1.95 ea

SPECIAL 5 for \$5.00 **SAVE \$4.75**

SMALL 73mm x 33mm Specifically designed for cars. Sticky on the front so you can stick them on the inside glass. Thieves will not know whether you have an alarm or not! Cat. LA-5100

NORMALLY 95¢ each

SPECIAL 10 for \$5.00 **SAVE \$4.50**





IBRE OPTICE

The EDU-LINK kit is a fibre-optic evaluation system consisting of TTL compatible transmitter board IR LED, one metre of fibre optic cable, photodiode and TTL compatible receiver board. The fibre optic connectors are also included. Full instructions - ideal for engineers, students and hobbyists as a learning aid. Cat. KJ-6520



ONLY \$49.95

UNCTION GENERATOR with DIGITAL READOUT

Ref: EA April 1982

This attractive unit produces sine, triangle and square waves over a range of 160kHz to below 20Hz. Low distortion and good envelope stability. Built-in 4 digit frequency counter for ease and accuracy of frequency setting Cat. KA-1428

ONLY \$119.50



TEMPERATURE PROBE F

IMEDI MANIMEDIANDIRIS



Ref: FTI June 1983 Simple add-on device extends your multimeters capability to measure temperature. Ideal for digital meters. Range from -55 to +150 degrees C or better Cat. KE-4033

ONLY \$27.95

DIRECT INJECT BOX

Ref: "Sonics"/ETI Sept 1985

This unit transforms an unbalanced signal to a balanced one

Full specs 1987 Jaycar Catalogue. Cat. KE-4708

ONLY \$42.50





THE 'LISTENING POST'

Ref: AEM July 1985

This device attaches between the audio output of a shortwave receiver and the input port of a computer. It allows decoding and printing out of morse code, radioteletype (RTTY) and radio facsimile (FAX) pictures Cat. KM-3015

\$39.95

8 SECTOR

BURGLAR ALARM

Ref: EA Jan/Feb 1985

Costs a lot less than often inferior units. A unique feature is its ability to have N/O and N/C sensors on the same line.

All parts supplied including 4 bonus deterrent stickers. Cat. KA-1582

ONLY \$135.00



SCREECHER" CAR ALARM SCARE THE PANTS OFF WOULD BE THIEVES!



ONLY \$32.50 -1,000's sold

This unit is fitted under the dash-board of your car. When a thief breaks in (after entry delay) an unbelievably shrill alarm goes off-INSIDE THE CAR.

The thief will be scared witless by the deafening noise of a demented 110dB monster canary - exit thief! The Jaycar kit includes the special high power piezo siren, dash lamp,

Cat. KA-1675

Cat. KE-4724

1406 PARAMETRIC EQUALISER MODULE



ONLY \$23.50

Ref: ETI August 1986 This individual module can be used on its own or ganged to equalise a whole system. 'Parametrics' can be made to tune around a centre frequency. For specifications see kit section of Jaycar's 1987 Catalogue.

ETI 1532 SOLDERING IRON TEMEPRATURE CONTROLLER

Save the cost of buying an expensive temperature controlled iron by building this kit. Simply plug your iron into the unit and you're into TC soldering! The Jaycar kit includes all parts and the

CatKE-4725

ONLY \$35.00

UPGRADED DIGITAL CAPACITANCE METER



Ref: EA August 1985 This is the improved version of the very popular March 1980 design. The new high impact plastic case, 4 digit display and ability to realistically measure from 1pF to 99.99uF. No adjustments are necessary, you simply connect the capacitor to the input terminals. Cat. KA-1595

ONLY \$85.00

AEM 4600 DUAL SPEED MODEM

Ref: AEM December 1985

This project enables you to construct a modem that operates at either 300 Baud full duplex or 1200/75 Baud half duplex (i.e. CCITT V.21 Orig; CCITT V.21 Ans; CCITT V.23 (mode 2) Orig & CCITT V.23 back) for a fraction of the cost of equivalent built units. Cat. KM-3040

ONLY \$169.00



30+30 WATT STEREO AMP

Includes pre-amp. Fully built and tested. Transformer to suit MM-2010 \$22.50 Cat. AA-0300

ONLY \$49.95



80+80 WRMS PRE-

MAIN AMP Complete pre-amp and high power amp. Size: 245(W) x 240(D) + heatsink 130(W) x 75(D) x

Cat. AA-0310

SAVE \$25 ONLY \$124.95





A must for all high power amplifiers. Measures 85(W) x 55(D) x 35(H)mm and draws very little current at 12V DC. Cat. AA-0320

ONLY \$22.95

FOR

PASSIVE INFRA RED DETECTOR WITH PULSE COUNT TRIGGERING

The absolute latest technology is used in this PIR. It employs a pulse count triggering circuit which virtually eliminates false alarms. The circuit first senses an alarm (pulse 1) and then goes into an alarm standby mode for 30 seconds. If during this period a second alarm event occurs (pulse 2) the unit goes into alarm mode and the standby period is extended a further 30 seconds. If there is no alarm pulse during this 30 seconds the unit returns to normal condition. Also suitable for single shot triggering. FOR FULL TECHNICAL DETAILS SEE THE NEW JAYCAR 1987 CATALOGUE - AVAILABLE NOW Cat. LA-5019



\$139.00

TELEPHONE CALL DIVERTER

SEE THE JAYCAR 1987

CATALOGUE FOR FULL

SPECIFICATIONS

This unit enables you to divert an incoming phone call to another location. The diverter will divert either line (2 lines required) or will divert only one incoming line. There are many other features which you will find out about this unit in THE BRAND NEW JAYCAR 1987 CATALOGUE - OUT NOW.



BRAND NEW DPM's

DPM 40

31/2 DIGIT LED DPM

Cat. QP-5542

\$79.95

DPM 125

3 1/2 DIGIT

ULTRACOMPACT

Cat. QP-5500

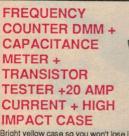
\$75.00

DPM 600

3 1/2 DIGIT BANDGAP REFERENCE DPM

Cat. QP-5516

\$89.95



Bright yellow case so you won't lose it! Fantastic specifications (see Jaycar 1987 catalogue) and a delight to use. Cat. QM-1555

> ONLY \$169.00



FM INDOOR ANTENNA Simple ribbon type antenna for strong signal areas. 300 ohm termination. Cat. LT-3002

NORMALLY

\$2.50 ~ **SAVE 50% ONLY \$1.25**



CARAVAN TV AERIAL

Suitable for car, caravan, boat. Designed for UHF, VHF and FM. Built-in masthead amplifier. Complete with cable and plug. Cat. LT-3120

> **SAVE \$30.00 NOW ONLY \$69.50**





PENLIGHT

NiCads

Don't waste money - buy rechargeable **NiCads**

SUPERB ROCKET BRAND AA PENLIGHT 450mA

Cat. SB-2452

\$3.50 ea OR



STD/ISD PHONE **CALL PREVENTION** MODULE

Connect in series with your phone turn the keyswitch and you can make STD/ISD calls - turn the key and remove to prevent

unauthorised calls. Cat. YT-6540



FLASHING LEDS

all 5mm, 5 volt operation RED Cat. ZD-1730 GREEN Cat. ZD-1731

YELLOW Cat. ZD-1732 \$1.50 each 10 or more

\$1.35 each



LED MOUNTING Hewlett Packard Brand

CLIPS

Black with interlocking collar, Suit 5mm LEDs.

PACK OF 20 Cat. HP-1102 \$1.50 PACK OF 100 Cat. HP-1103

\$5.00

SOCKET PACKS

The economical way to purchase quality tinned IC sockets

ALL PACKS OF 100 UNITS Pins PI-6478 8 \$15.50 PI-6480 14 \$16 95 PI-6482 16 \$19.95 18 PI-6484 \$23.95

MIXED PACK OF IC SOCKETS

Consists of: 15 x 8 pin 20 x 14 pin

20 x 16 pin 10 x 18 pin 5 x 20 pin

10 x 22 pin 5 x 24 pin 5 x 28 pin

10 x 40 pin Cat. PI-6490

PACK OF 100 UNITS \$37.00 VALUE FOR \$25.95 **APRIL ONLY TAKE** 20% OFF ALL IC SOCKET PRICES

NEW LOWER PRICES ON CRYSTALS...

SHOWN ABOVE

RQ-5260 1.000MHz RQ-5264 1.8432MHz \$ 9.50 RQ-5268 2.000MHz \$ 8.50 RQ-5269 2.4576MHz \$ 8.50 RQ-5271 3.000MHz \$ 5.50 RQ-5272 3.5795MHz \$ 4.00 RQ-5274 4.000MHz \$ 5.50 RQ-5277 4.433619MHz \$ 5.50 RQ-5280 4.9152MHz 5.50 RQ-5283 5.000MHz 5.50 RQ-5285 8.0000MHz 5.50 RQ-5286 8.867238MHz 5.50 RO-5289 10.000MHz \$ 5.50 RQ-5291 10.695MHz 1.95 RQ-5292 12.000MHz \$ 5.50 RQ-5294 16.000MHz \$ 5.50 RQ-5296 20.000MHz \$ 5.50







er Prices Slashed

5" MIDRANGE POLYPROPYLENE

Power handling 80 watts rms system into 8 ohms. Resonant frequency 600Hz and a sensitivity of 90dB/W @ 1 metre. Cat. CM-2085

SAVE \$9.50

ONLY \$20.00 ea



FOSTER 8" WHITE CONE

Best 8" woofer we've seen. Looks great sounds great. Ferrofluid 30 watts rms. Frequency response 50 - 3000Hz. Resonant frequency 50Hz. 99dB/0.5 metre

Cat. CW-2111 SAVE \$7.00 ONLY \$19.95 ea

FOSTER DOME TWEETER

DO25N25 model. System power 150 Watts rms. Resonance frequency 1.2khz.
Frequency range 3kHz - 30kHz. 91dB/W @ Cat. CT-2018

SAVE \$8.00

ONLY \$24.50 ea



FOSTER HORN **TWEETER**

This tweeter is brilliant. It is very bright and crisp. Frequency range 5kHz - 40kHz. System power 100 Watts rms. 96dB/W @ 1 metre sensitivity.

Cat. CT-2016 SAVE \$8.00

ONLY \$24.50 ea



GRILLE CLOTH

High quality, acoustically transparent. Is ideal for all speaker cabinets. 1.5 x 1 metre roll. Colour black

Cat. CF-2752 SAVE \$3.00

ONLY \$8.50



SPEAKER SEALANT

Special non-hardening sealing compound. Ideal for airtight seal between speaker drivers and cabinet. Essential for acoustic suspension designs. 2 metre roll. Cat. CF-2762

SAVE \$1.00

ONLY \$1.95

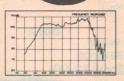
PIONEER 12" **GUITAR SPKR**

Around half the price of other makes. A superb Pioneer unit. 100 watts rms, frequency response 80 - 4000Hz, SPL 100dB/0.5m. Huge 4,002 gram magnet. Cat. CG-2380

SAVE \$14.50

ONLY \$75.00 ea





PIONEER 418 12" WOOFER

White cone and chrome surround with superb specs. A winner. 65 watts rms, frequency response 25 - 2500Hz, resonant frequency 25Hz, SPL 97dB/0.5m Cat. CW-2121

SAVE \$10.00

ONLY \$39.50 ea





POLYPROPYLENE

Handles 70 watts rms system into 8 ohms. Resonant frequency 24.3Hz and frequency response of 24Hz - 6kHz. 91.9dB/W @ 1 metre. Electromagnetic Q = QES 0.398 and a peak cone excursion of 2 x/max 1.25mm.

SAVE \$14.50

ONLY \$55.00 ea



NEGATIVE AIR

The Country Air negative air ioniser was advertised extensively around a year ago for \$200. We have bought the manufacturers distressed stock and can pass on massive savings to youl A high quality product. Cat. YX-2902

SAVE A FURTHER \$20 APRIL ONLY

> ONLY \$49.95



QUARTZ CRYSTAL **CLOCK MOVEMENT** SUPPLIED WITH 3 SETS OF HANDS

Very compact unit (56mm square x 15mm deep) that can be used in your own design of clock face. Self starting one second stepping motor has strong torque. Powered by 1 x 1.5V AA battery that lasts around one year. Accuracy is

±15secs/month. ONLY Cat. XC-0100





FRIGI-FRESH **ELECTRONIC REFRIGERATOR** DEODORISER

This unit automatically circulates the air in your fridge after each door opening. A special filter removes odours and circulates a fresh smell through your fridge. The unit turns off after 12 seconds. Uses 4 x AA cells (not supplied).

Size: 100(W) x 90(H) x 88(D)mm. Simply sits at the back of your fridge on a shelf. Cat. YF-5522

Spare filters Cat. YF-5523 \$3 ea



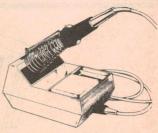


BONUS OFFEI

WELLER WTCPN SOLDER STATION

Buy the Weller station in April and receive a BONUS 2 rolls of solder absolutely FREE. Full details on the Weller WTCPN in the 1987 Jaycar Catalogue. Cat. TS-1000

\$149.50



ULTRASONIC PEST & INSECT REPELLER (Full details 1987 Jaycar Catalogue)

Cat. YS-5510

SAVE \$15.50 ONLY \$39.50

AR JAYCAR JAYCAR

THE ULTIMATE PERFECT PARTNERS NEW **AEM 6000 POWER AMPLIFIER**

By David Tillbrook. This superb power amplifier has an output of 240 watts rms into 8 ohms or a massive 360 watts rms into 4 ohms. The laycar kit includes all parts including 300VA toroidal trans-

Cat. KM-3020

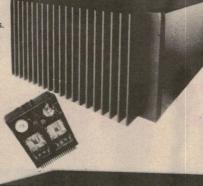
"ULTRA FIDELITY" PREAMPLIFIER

REF: AEM OCT - DEC 1985 Cat. KM-3030

\$998 Power Amp \$359 Pre Amp

APRIL BARGAIN BUY BOTH FOR **ONLY \$1257 SAVE \$100**

\$1357



GENERATION CORDLESS PHONE

MICROPROCESSOR CONTROLLED -200 METRES RANGE AND ABSOLUTE SECURITY

Quite simply the finest cordless phone we have appraised. Naturally it is in total conformity to the 1986 Telecom specifications and is Telecom approved. The range with the 39/30MHz RX/TX FM system is fabulous - as against the very

short range of cordless phones of yester-FEATURES:

- # Operating range up to 750ft (250m) # Security code system with 16,384
- combinations # Last number redial
- # LED indicator on handset for low battery indication

\$269

Hearing aid compatible Cat. YT-7065

ELECTRIC FENCE" Mains or battery powered. Kit does not include automotive ignition coil. Adequate

parts.

Cat. KA-1678

Cat. KA-1109 Ref: EA



deterrent for all manner of livestock.

\$21.50

ELECTRIC FENCE

KITS

HIGH POWER
Ref: EA October 1986

The ultimate electric fence. Will power

fence runs up to 1km+ and still pack a

NORMALLY \$229

SAVE \$30.00

ONLY \$199

FENCE MASTER

wet grass, poor insulation, etc. 12V powered. The Jaycar kit contains all

punch. Low output impedance overcomes

ELECTRIC FENCE CONTROLLER

Ref: EA December 1985 NEEDS NO AUTO COILI

Uses special output transformer so it is more likely to work into false loads. It has low current drain coupled with higher performance. The Jaycar kit is supplied with all parts including a length of HT cable and heavy HT connecting clip. \$49.95



GORE HILL OPEN SATURDAY UNTIL 4pm

PLAYMASTER 60/60 STEREO AMPLIFIER WITH AUSTRALIAN MADE TRANSFORMER

High quality, low priced stereo amplifier. See EA May/June/July 1986

Cat. KA-1650 MORE

POWER!! \$299



DUAL TRACKING POWER SUPPLY

Ref: EA Feb 1987

Will supply up to ±21.5V at 500mA. At 5V it will supply 3A and at 10-16V 2 amp.

\$129.50





3 BAND SHORTWAVE RADIO

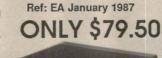
Great for budding SWL or amateurs.

This kit will tune from 0.48MHz thru to 17MHzI The project features high sensitivity, one IC in the RF section and high performance at a low, low cost. Battery operated.

Cat. KA-1681

SYDNEY

GORE HILL





BI-FET PREAMP Pre-built unit - superb specs.

Cat. AA-0315 **6 WATT MICRO AMP**

1 CHANNEL

amplifier your Walkman. Cat. AA-0340

ONLY \$69.95

ONLY \$13.95



(02) 744 0767

PLACE YOUR MAIL

ORDERS BY

FACSIMILE

See EA December 1986 Unmetered version Cat. KA-1680

\$139.00

Cnr Carlingford & Pennant Hills Rd. (02) 872 4444. Mon - Fri 9 am - 5.30 pm Thurs until 8.30 pm. Sat 9 am - 12 noon CARLINGFORD

115 Parramatta Rd. (02) 745 3077 Mon - Fri 8.30 am - 5.30 pm only CONCORD HURSTVILLE

121 Forest Rd. (02) 570 7000 Mon - Fri 9 am - 5.30 pm Thurs until 8.30 pm. Sat 9 am - 12 noon 188 Pacific Hwy (Cnr Bellevue Ave) (02) 439 4799. Mon - Fri 9 am - 5.30 pm



QLD. BURANDA 144 Logan Rd. (07) 393 0777 Mon - Fri 9 am - 5.30 pm

115 Parramatta Rd Concord 2137 (02) 747 2022. Telex 72293





AMERICAN EXPRES! FAX (02) 744 0767

MAIL ORDER VIA YOUR PHONE

MAIL ORDERS Box 185 Concord 21: 747 1888 **HOTLINE** FOR ORDERS ONLY

POST & PACKING \$9.99

SHOWROOMS

117 York St. (02) 267 1614 Mon - Fri 8.30 am - 5.30 pm Thurs until 8.30 pm. Sat 9 am - 12 noon

ROAD FREIGHT ANYWHERE IN AUSTRALIA \$13.50

Run your CD player from your car battery

12/240V inverter for portable CD players

Here's how to use your portable CD player in your car without having to rely on the limited capacity of rechargeable nicad batteries. This small 12/240V inverter has been specially designed to power portable CD players but can also be used for other mains powered devices which draw 15W or less.

by JOHN CLARKE

There is no denying it. Portable CD players are fantastic. They represent a mind-boggling concentration of high technology into a very small package. And even though their performance might not be up to the ultimate standards of conventional CD players, they

are still streets ahead of any other hifi program source.

So it is not surprising that portable CD players are becoming so popular. They can be used virtually anywhere, on the run using headphones or at home, connected to the hifi system.

However, their potential for use in the car has yet to be fully realised.

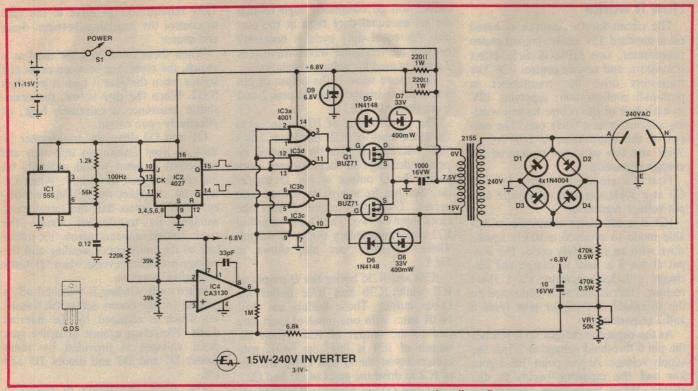
There are a number of problems in using a portable CD player in a car. First, unless you are a passenger, you can't use headphones. If you are the driver you could not even consider using headphones because you would be too isolated from the sounds of the road and surrounding traffic.

Second, there is the question of how you connect the CD player into your car's existing sound system. Unless they are new models, most systems make no provision for portable CD players. In the near future, more and more radio/cassette players will be fitted with jacks for connection of CD players.

Although the player can be operated using the internal rechargeable batteries of the CD player, it is far more practical to provide power via the car battery.



The new inverter can be used to power any portable CD player which has a plugpack adaptor and draws up to 15W.



The circuit employs field effect transistors Q1 and Q2 to drive a transformer in push-pull configuration. The output voltage is sampled and fed to IC4 which controls the "dead" time of each transistor during every half cycle.

This will provide unlimited playing time from the player.

Powering a CD player directly from the car battery is not as simple as it may appear. There are several safeguards necessary to ensure sound quality and to protect the CD player from the voltage transients common to a car electrical system.

First, the negative return of the DC supply should be isolated from the signal output ground to prevent the possibility of a current loop (ie, equivalent to an earth loop in an audio system). If this is not done, noise and distortion could well prove a problem. In addition, the DC supply to the player needs to be regulated and must incorporate transient suppression.

Some CD players are much more difficult than others to power from a car's electrical system. Whereas the Sony players need only a single 9V supply, others such as the Technics SLP-X7 require ±6V. This is very awkward as it requires the use of a DC-to-DC inverter. We could have designed such an inverter but then we had to face the fact that these players have a special DC power socket which would be hard to obtain.

12/240V AC inverter

Since all portable CD players are supplied with a 240VAC plugpack adaptor, we realised we could meet all the above

problems with one solution — a 12V DC to 240VAC inverter circuit. The resulting inverter will power any portable CD player which has a plugpack AC adaptor and draws up to 15W. It will also run any other mains-powered appliance with a rated power consumption up to 15W.

Incidentally, we are indebted to Sean McCarthy of Swindon, UK for this project idea. Sean was a visitor to Australia during 1986.

As shown in the photographs, our new inverter is housed in a compact steel box with a sloping front panel. It has a mains socket mounted on the front lid and an on/off switch. A twin lead from the rear of the case is fitted with a plug which plugs into the car's cigarette lighter socket.

Alternatively, readers may wish to install the unit beneath the dash and permanently connect the unit to the vehicle 12V supply via the accessory fuse.

Although the inverter is only a low power unit, its line regulation is impressive. For an input voltage range of 11VDC to 15VDC, the output voltage changes from 240VAC to 249VAC. Load regulation at 12V input is equally impressive, changing from 242VAC at no load to 241VAC at 15W load.

The efficiency at full load (15W) is 82% with the current drain just on 1.5 amps DC. Standby current at no load is 120mA.

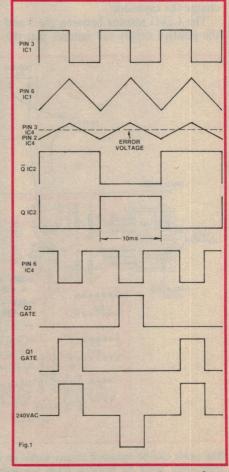


Fig.1: this diagram shows the waveforms at various points on the circuit.

How it works

The circuit for the inverter is based on a standard 15V centre-tapped mains transformer, two SIPMOS field effect transistors, and several control ICs. The transistors drive the transformer in push-pull configuration, supplying 12V to each half of the centre tapped winding alternately at a 50Hz rate. The output of the transformer is 240VAC at 50Hz and this output is monitored for voltage regulation.

Four ICs are used to drive O1 and Q2 at a 50Hz rate and to provide out-

put voltage regulation.

IC1 is a 555 timer connected in astable mode to produce a 100Hz square wave with an even duty cycle. The output at pin 3 is used to charge and discharge a $0.12\mu F$ capacitor via a $56k\Omega$ resistor. This capacitor is connected to the threshold and trigger pins (pins 6 and 2 respectively).

As the capacitor charges up it reaches the pin 6 threshold voltage at 2/3rds the supply voltage. At this point, pin 3 goes low and the capacitor begins to discharge. When the voltage reaches the pin 2 trigger voltage at 1/3rd of the supply voltage, pin 3 goes high again to recharge the capacitor.

The $1.2k\Omega$ resistor between pin 3 and the positive supply rail ensures that the

output will go completely high so that we get an equal duty cycle at the output. An equal duty cycle is necessary because the triangular waveform at pins 2 and 6 is used for voltage regulation.

The square wave at the output of pin 3 and the triangular wave at pins 2 and 6 are shown in Fig.1.

The pin 3 output of IC1 connects to the clock input of IC2, pin 13. IC2 is a 4027 J-K flipflop with the J and K inputs pulled high so that on every clock pulse, the Q output at pin 15 toggles (ie, changes from high to low or vice versa). Thus, the output divides the clock input by two. The O-bar output of IC2 is complementary to the Q output. These waveforms are also shown in Fig.1.

IC3a and IC3d buffer the Q output of IC2 while IC3b and IC3c buffer the Q-bar output. These buffers are 4001 NOR gates with one input of each gate tied to the output of IC4. When the output of IC4 is low, the NOR gate buffers invert the Q and Q-bar outputs of IC2 to drive the gates of Q1 and Q2.

Q1 and Q2 are Siemens Power Metal Oxide Semiconductors, or SIPMOS for short. They can be regarded as conventional power field effect transistors with an integral reverse protection diode between the drain and source electrodes.

They require voltage drive to the gate to control the resistance between drain and source.

When these transistors are used as a switch, the resistance between drain and source when the gate is high is less than 0.1Ω . When the gate is low, the drainsource resistance is extremely high, or effectively open circuit.

Q1 and Q2 drive the transformer in back to front fashion so that they are connected to what would normally be the centre-tapped secondary. When Q1 turns on, it applies the full battery voltage of 12V across half the transformer winding. By transformer action, the same voltage appears across the other half of the transformer winding and the voltage polarities reverse when Q1 turns off and Q2 turns on.

When each winding is switched off, a reverse voltage occurs across the transistor which is clamped by the internal diode. Protection against excessive gate drain voltages is provided by zener diodes D7 and D8 and diodes D5 and D6.

The above description of operation applies to a simple push-pull inverter but our circuit also has regulation. This is obtained by having a certain amount of "dead" time between O1 turning off and Q2 turning on, and vice versa.

Regulation

A full wave rectifier consisting of diodes D1 to D4 is connected across the transformer output winding. The resulting rectified output is attenuated using the two series $470k\Omega$ resistors and a 50kΩ trimpot. A 10μ F capacitor filters the signal to provide a smooth DC voltage which is proportional to the peakto-peak output voltage from the transformer.

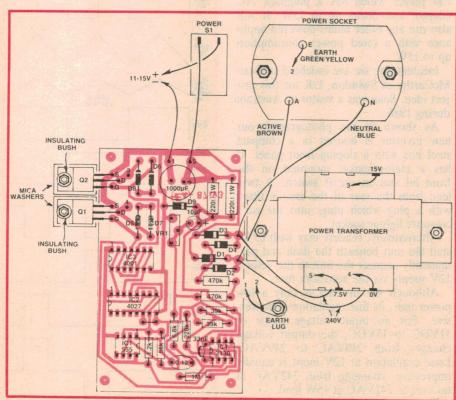
This sample DC voltage is applied via a 6.8kΩ resistor to the non-inverting input of IC4, which is an op amp con-

nected as a comparator.

The other (inverting) input of IC4 is fed an attenuated version of the triangular waveform from pin 2 of IC1 via a $220k\Omega$ resistor. This input (pin 2) is also referenced to half supply by the 39kΩ voltage divider resistors connected between the positive supply rail and ground.

The waveforms at pin 6 of IC1 and those at pins 3 and 2 of IC4 are shown in Fig.1. The output of IC4 (pin 6) is high whenever its pin 3 voltage is higher than its pin 2 voltage and vice versa. Therefore, the output of IC4 changes each time the voltage at pin 2 flicks above or below the voltage at pin 3.

As previously mentioned, the IC3



The parts can be mounted in any order on the PCB. Note that the metal tabs of the two transistors must be isolated from the metal case using mica washers and insulating bushes.

Rod Irving Electronics No.1 for semiconductors



RNE 48 A'Beckett Street, Phone (03) 663 6151. NORTHCOTE 425 High Street, Phone (03) 489 8866. ER HOTLINE: (03) 543 7877

.50 .50 1.90 1.90 .60 .60 .90 .90 .90

1.20 1.90 .90 1.00 1.00 1.95 3.95 1.00 1.10 1.10

M	ELB	ou
SERIES 4000	.50	74150 74151
4001 4002	50 50 50 50 50 50 50 50 50 50 50 50 50 5	741507 74151
4007 4008	.40 1.20	74161 74163 74164
4010 4011	.90	74165 74166
4012 4013 4014	.60	74174 74175 74180
4015 4016	1.90 1.00	74190 74191
4017 4018 4019	1.50 1.90	74192 74193
4020 4021	1.50 1.50	74195 74197
4022 4023	1.50	74221 74367
4025 4026	1.50	75107 75110
4027 4028	1.50	75150 75154
4029 4030 4031	1.50	75450 75451 75452
4032 4033	2.75 2.75	75453 75461
4034 4035 4038	3.50 1.95	75462 75471
4040 4041	1.20	75472 75491 75492
4042 4043	1.00	75493
4044 4045 4046	1.20 4.90	74C00
4047 4048	1.20	74C04
4049 4050	1.00	74C10
4051 4052 4053	1.50	74C20
4053 4054 4055	3.90 3.90	74C42
4056 4060	4.20 2.50	74C73
4063 4066 4067	2.50	74C76
4068 4069	1.00	74C86
4070 4071	.90	74C90 74C93
4072 4073 4075	.90	74C95
4076 4077	1.50	74C15
4078 4081	.80	74C15
4082 4085 4086	2.20	74C007 74C007 74C007 74C007 74C07 74
4093 4094	.75 3.35	74C16
4095 4096	2.40	74C17
4098 4099	2.90	74C19
4194 4510	1.95 1.50	74C19
4511 4512	1.20	74C20
4514 4515	2.90	74C2
4516 4517	1.45 8.75	74C3
4518 4519 4520	1.90	74C90
4521 4522	3.90	74C9
4526 4527	1.85	74C9
4528 4558 4584	2.25	74C9 74C9
4585	2.10	74C9 74C9
74 SERI 7400 7401	.80 80	74C9
7402 7403	.80	74C9 74C9
7404 7405	.80	74C9:
7406 7407 7408	.80	74C9:
7409 7410	.60	74C9 74C9
7411 7412	.70 .70	74C9 74C9 74C9 74C9 74C9 74C9 74C9 74C9
7413 7414 7416	.80	
4001 4002 4006 4007 4001 4011 4011 4011 4011 4011 4011	.80 .80 .80 .80 .80 .80 .80 .80 .80 .80	74F S 74F0 74F0 74F0 74F1 74F1 74F3 74F3 74F6 74F1 74F1 74F1 74F1 74F1 74F1 74F1
7425 7427 7430	.90 .80	74F0. 74F0. 74F0. 74F1. 74F1. 74F2. 74F3. 74F6. 74F1.
7432 7437	1.00	74F1 74F2
7438 7440	1.00	74F3: 74F6
7445 7446	1.95	74F74 74F84 74F14
7447 7449	1.50 1.20	74F1 74F1
7450 7451 7473	1.00	74F1
7474 7475	1.00	74F1 74F1
7476 7485	1.50 1.80	74F1
7486 7489 7490	1.80 3.90 1.20	74F1

1.20 1.20 2.75 1.65 1.20 .90 1.50 .90 1.50 1.00 1.80 1.00

et, r		6 (00)	
	MA	ILOR	D
745473	9.90	NE555	.6
745473	9.90	NE556	1.2
745475	9.90	NE558	5.0
745482	11.90	NE560	4.6
745489	7.90	NE567	2.0
		NE570	5.9
8000 SER	LIES	NE571 NE592	5.9
8035 8039	6.90 7.90	NE592 NE594	9.5
8080	6.00	LM709-14	1.5
8085	9.50	UA710CN	1.0
8086	19.50	LM711 LM723	1.2
8088	19.50	LM723	.7
8121	5.00	LM723CH	1.5
8123	4.00	LM725	4.7
8130 8131	6.95 5.95	LM733 LM739	1.5
8136	6.95	LM741	.6
8155	6.50	UA747	1.3
8156	11.50	· UA748	1.0
8185	37.50	MC1310	9.5
81LS95	3.75	MC1312	7.9
81LS96	3.75	MC1314	7.9
81LS97	3.75	MC1315	8.9
81LS98 8212	3.75	MC1327 MC1350	7.9
8214	4.90	MC1408L8	
8224	3.50	MC1437	4.9
8226	4.90	MC1445	5.9
8228	5.50	MC1456	1.9
8237	19.50	MC1458	1.2
8238	9.50	MC1466L	21.5
8243	8.50 6.90	MC1469R MC1488	6.9
8251 8253	7.50	MC1488 MC1489	1.2
8253	5.50	MC1489 MC1494	8.4
0233	0.00	mv 1434	0.4

LM711	1.20
LM723	.75
LM723CH	1.50
1 M725	4.75
LM733 LM739 LM741 UA747	1.50
LM739	2.75
I M741	.60
HAZAZ	1.30
· UA748	1.00
MC1310	9.50
MC1312	7.95
MC1314	7.95
MC1314	8.95
MC1315	
MC1327	7.95
MC1350	1.95 3 7.50
MC1408L	3 7.50
MC1437	4.95
MC1357 MC1408L8 MC1437 MC1445 MC1456 MC1458	5.95
MC1456	1.95
MC1458	1.20
MC1466L	21.50
MC1469R	6.90
MC1488	1.20
MC1489	1.20
MC1494	8.40
MC1495 MC1496	8.90
MC1496	2.50
LM1596	3.00
MC1648	8.90
LM1812	10.50
LM1830	3.90
LM2907	3.90
LM2917 8	
Lm2917 0	4.90
LM2917 14	
Lm291/1	4.90
MN3001	17.50
CA3028	2.00
CA3028	2.00
CA3046	1.90

MAN74 (DL7

LM2907	3.90
LM29178	PIN
	4.90
LM2917 1	4 PIN
	4.90
. MN3001	17.50
CA3028	2.00
CA3046	1.90
CA3056	6.50
CA3059	5.95
CA3046 CA3056 CA3059 CA3080 CA3086	1.90
CA3086	1.90
CA3100E	7.95
CA3130E CA3130T	2.90
CA3130T	3.50
CA3140E	2.20
CA3140T	2.95
CA3240E	11.95
CA3401	1.00
CA3900	1.20
CA3905	1.75
CA3909	2.95
LM3911	2.95
LM3914	5.90
LM3915	5.90
CA3401 CA3900 CA3905 CA3909 LM3911 LM3915 LM3916 LM3999Z RL4136 RC4145 RC4194	5.90
LM3999Z	2.60
RL4136	1.95
RC4145	20.90
RC4194	3.90

	1.80	HC4134	3.30
	1.00	CDP	
A.R		CDP1802	16.50
12	9.50	CDP1864	
2CH			
0	9.50	CPU	
71	9.50	6502	15.00
	1.50	6502A	15.00
	2.90	6522	15.00
	4.90	6522A	15.00
	1.20	6532	14.00
	2.90	6551	12.90
0.93	3.20	6800	6.00
1	4.90	6802	7.00
	1.90	6808	12.50
	2.50	6809	10.00
	2.90	6810	3.50
	3.45	6821	5.50
	4.90	6840	6.50
20	9.50	6845	12.50
80	4.50	6847 6850	3.50
024	2.80	6875	7.90
)5P	17.50		5.00
	5.95	Z80CPU	
70 80	3.75	Z80ACPU Z80BCPU	5.00
CH	7.50	Z80BCP0 Z80P10	4.50
1	1.00	Z80AP10	4.50

. 600 . 600

Z80CPU	5.00
Z80ACPU	5.00
Z80BCPU	112.00
Z80P10	4.50
Z80AP10	4.50
Z80CTC	5.50
Z80ACTC	5.50
Z80DMA	16.00
Z80ADMA	4 16.00
Z80AS10	13.00
Z80S10	13.00
AD570	69.50
AD590	9.50
AD7524	
AY-3-8910	
AY-3-251	
MSM5832	
MM58174	
MM5309	14.50
MM5369 FD1771	4.95
FD1771	19.00
FD1791 (8876)
	39.00
FD1793 (
	39.00
FD1795	39.00
FD1797	39.00
WD1691	29.50

FD1771	19.00
FD1791 (
- LEGISLAND	39.00
FD1793 (
	39.00
FD1795	39.00
FD1797	39.00
WD1691	29.50
WD2143	24.50
WD1931	22.50
WD1933	34.00
WD1983	14.75
	59.00
WD2123	
WD8250	29.50
TR1602 (
	8.50
TR1853	8.90
COM8116	5 24.00
BR1941	23.00
CRT8002	A
	59.90
MEMORY	7
2102	2.50
2114	4.95
2708	12.50
2716	9.90
2/16	9.90

1.90 3.50 3.50 5.95 3.50 1.95 2.00 2.95 2.90 1.00 6.95 9.95 22.50

74S428/8212

20	BC633
20	BC640
90	BCY70
50	BCY71
50	BD139
50	BD140
36	BD232
90	BD233
	BD235
-0	BD236
50	BD237
50	DD237
50	BD236
50	BD262
50	BD263
00	BD437
50	BD488
50	BD647
50	BD648
00	BD677
50	BD681
50	DDG01
90	DOUGAR
50	DDVOGD
90	BDA02B
50	BDX63
00	A86 (BOX 8
95	
95	BDY97 (BU
50	
2)	BF115
50	BF180
4)	BF182
50	BF183
)E	BF184
NE .	BF198
10	BF199
STATE OF THE PARTY OF	BE200
15	BE245
35	BE337
	DE339
15	DEAGO
30	DF458
30	BF459
15	DF469
30	BF470
30	BF494
30	BFW10
an .	BFW11
30	BFW16
20	BFY50
0	BFY90
	BU126
20	B11209
	BU208
L	BU326
20	BUX80
E	MFE131
00	MFE3001
	MFE3003
	MJ413
	MJ802
45	MJ901 1
25	M 11001
25	M.111011
90	MJ11011
90	MJ11015
26	MUTTOTO
95	MJ15003
95	MJ15004
95	MJ15024 1
50	MJ2501
50	MJ2955
50	MJ3001
95	MJ4032 1
95	MJ4502
90	MJE340
90	M.IE350
95	M.IE371
20	M.IES21
05	MIEZOO
30	MJE/UU
95	MJE800
50	MJE2801
50	MJE2955
50	MJE3055
90	MJE13005
50	MJE13007
50	MJE13009 1
95	MPF121
80	MPF131
50	MPSA05
50	MPSAGE
50	MPSA10
95	MPSA12
50	MDCA12
50	MPSA13
50	MPSA14
50	MPSA20
95	MPSA42
90	MPSA43
50	MPSA55
50	MPSA56
50	MPSA63
900 900 900 900 900 900 900 900 900 900	MPSA65
95	MPSA92
See.	MPSA93
	MPE102
	MDE102
OF BE	MPF103
	MPF105
50	MPF106
5030	MPF109
95	MPSL01
SE SE	MPSL51
50	MPSU02
Borto.	MPSU52
50	MPSUSE
1	MD121
05	
	MDECOL
	MRF221
06	MRF221 MRF237
95	MRF221 MRF237 MRF238
95 95	MRF221 MRF237 MRF238 MRF245
1 50 1 95 1 50 1 50 1 95 1 95 1 95 1 95	BUC930 BCY71 BCY71 BCY71 BCY71 BCY71 BCY71 BCY71 BD139 BD1439 BD139 BD139 BD1233 BD233 BD337 BD3

BD238 BD262			
	1 20	2N2907	1.10
BD263	1.20	2N3019	1.10
BD437	1.50	2N3054	1.90
BD488	1.50	2N3055	1.20
BD647	1.80	2N3096	1.20
BD648	1.80	2N3109	1.90
BD681	2.00	2N3302	1.90
BD682	2.00	2N3440	1.80
BDV64B	5.50	2N3441	2.90
BDV65B	5.50	2N3442	3.50
ADY 02	80)	2N3563	.31
130 (DUX	4 90	2N3565	31
BDY97 (BI	UX 80)	2N3566	.3(
	4.90	2N3567	.31
BF115	1.50	2N3568	.30
BF180	1.20	2N3569	.30
BF183	60	2N3638	.3
BF184	.60	2N3641	31
BF198	.60	2N3642	.31
BF199	.60	2N3643	.31
BF200	1.20	2N3644	.31
BF337	1.50	2N3645	3
BF338	1.90	2N3702	1.2
BF458	1.00	2N3704	1.4
BF459	1.00	2N3739	4.5
BF409	1.20	2N37/1	5.5
BF494	90	2N3773	5.0
BFW10	1.50	2N3792	6.0
BFW11	1.50	2N3819	1.2
BFW16	1.50	2N3866	2.9
BFT50	1.20	2N3904 2N3906	1.0
BU126	2.95	2N4030	1.5
BU208	4.90	2N4032	2.2
BU326	3.90	2N4033	2.2
BUX80	4.90	2N4036	2.5
MFE3004	2.90	2N4121	1.5
MFE3003	6.95	2N4236	1.0
MJ413	5.90	2N4237	1.9
MJ802	7.50	2N4248	.4
MJ901	4.50	2N4249	.4
MJ1001	3.90	2N4250	.4
M.111015	14.50	2N4256	.5
MJ11016	14.50	2N4356	.5
MJ15003	6.50	2N4360	1.0
MJ15004	6.50	2N4401	.3
MJ15024	10.00	2N4402	.3
MJ2955	2.50	2N4416	1.9
MJ3001	8.00	2N4427	3.9
MJ4032	12.50	2N4919	2.9
MJ4502	6.90	2N5088	1.0
MJE340 MJE350	1.50	2N5089	1.0
M.JF371	2 90	2N5139	1.2
MJE521	2.50	2N5190	2.5
MJE700	3.50	2N5191	3.3
MJE800	2.90	2N5192	3.1
MJE2801	3.95	2N5193	2.5
MJE2955	3.90	2N5194	3.3
MJE13005	5 5.90	2N5210	1.5
MJE13007	7 7.90	2N5245	1.5
MJE13009	12.50	2N5303	8.5
MPF121	2.50	2N5401	1.5
MPSA05	1.00	2N5458	9
MPSA06	1.00	2N5459	.9
MPSA10	1.00	2N5461	.9
MPSA12	1.00	2N5462	.9
MPSA13	1.00	2N5485 2N5486	.9
MPSA20	1.00	2N5489	14.5
	1.00	2N5590	
MPSA42			26.5
MPSA42 MPSA43	1.20	2N5591	26.5
MPSA42 MPSA43 MPSA55	1.20	2N5591 2N5641	26.5 29.5 19.5
MPSA43 MPSA55 MPSA56	1.20	2N5591 2N5641 2N5656	26.5 29.5 19.5 2.5
MPSA42 MPSA43 MPSA55 MPSA66 MPSA63 MPSA65	1.20 1.00 1.00 1.00	2N5591 2N5641 2N5656 2N5770 2N5777	26.5 29.5 19.5 2.5 .3
MPSA42 MPSA43 MPSA55 MPSA63 MPSA63 MPSA65 MPSA92	1.20 1.00 1.00 1.00 1.00	2N5591 2N5641 2N5656 2N5770 2N5777 2N5830	26.5 29.5 19.5 2.5 .3 1.5
MPSA42 MPSA43 MPSA55 MPSA63 MPSA63 MPSA92 MPSA93	1.20 1.00 1.00 1.00 1.00 1.00 1.20	2N5591 2N5641 2N5656 2N5770 2N5777 2N5830 2N5831	26.5 29.5 19.5 2.5 .3 1.5 .3
MPSA42 MPSA43 MPSA56 MPSA56 MPSA63 MPSA65 MPSA92 MPSA93 MPF102	1.20 1.00 1.00 1.00 1.00 1.00 1.20	2N5591 2N5641 2N5656 2N56770 2N5777 2N5830 2N5831 2N5831 2N5873	26.5 29.5 19.5 2.5 3 1.5 3 1.4
MPSA42 MPSA43 MPSA56 MPSA63 MPSA65 MPSA65 MPSA92 MPF102 MPF103	1.20 1.00 1.00 1.00 1.00 1.00 1.20 .90	2N5591 2N5641 2N5656 2N5777 2N5777 2N5830 2N5831 2N5873 2N5874 2N5944	26.5 29.5 19.5 2.5 3 1.5 3 1.4 1.7
MPSA42 MPSA43 MPSA56 MPSA63 MPSA63 MPSA92 MPSA92 MPF102 MPF103 MPF105 MPF106	1.20 1.00 1.00 1.00 1.00 1.00 1.20 .90 .90	2N5591 2N5641 2N5656 2N5770 2N5777 2N5830 2N5831 2N5873 2N5874 2N5944 2N5945	26.5 29.5 19.5 2.5 3 1.5 3 1.4 1.7 29.9 39.9
MPSA42 MPSA43 MPSA55 MPSA56 MPSA63 MPSA92 MPSA93 MPF102 MPF103 MPF105 MPF106 MPF109	1.20 1.00 1.00 1.00 1.00 1.00 1.20 .90 .90 .90	2N5591 2N5641 2N5656 2N5777 2N5777 2N5830 2N5831 2N5873 2N5874 2N5944 2N5945 2N5946	26.5 29.5 19.5 2.5 3 1.5 3 1.4 1.7 29.9 39.9 44.9
MPSA42 MPSA43 MPSA56 MPSA56 MPSA65 MPSA92 MPF102 MPF103 MPF105 MPF106 MPF109 MPSL01	1.20 1.00 1.00 1.00 1.00 1.00 1.20 .90 .90 .90 .90	2N5591 2N5651 2N5656 2N5770 2N5777 2N5830 2N5831 2N5873 2N5874 2N5944 2N5945 2N5946 2N5946	26.5 29.5 19.5 2.5 3 1.5 3 1.4 1.7 29.9 39.9 44.9
MPSA43 MPSA55 MPSA55 MPSA63 MPSA63 MPSA93 MPF102 MPF105 MPF106 MPF106 MPF109 MPSL51 MPSL51	1.20 1.00 1.00 1.00 1.00 1.00 1.00 1.20 .90 .90 .90 .90	2N5591 2N5641 2N5656 3N5770 2N5777 2N5830 2N5831 2N5873 2N5874 2N5944 2N5945 2N5946 2N5961 2N6027 2N6027	26.5 29.5 19.5 2.5 3 1.5 .3 1.4 1.7 29.9 39.9 44.9 1.0
MPSA43 MPSA55 MPSA55 MPSA63 MPSA63 MPSA93 MPF102 MPF105 MPF106 MPF106 MPF109 MPSL51 MPSL51 MPSU02 MPSU52	1.20 1.00 1.00 1.00 1.00 1.00 1.20 .90 .90 .90 .90 1.50 1.50 1.75 1.90	2N5591 2N5641 2N5656 2N5770 2N5777 2N5830 2N5831 2N5873 2N5874 2N5944 2N5945 2N5946 2N5961 2N6049 2N6049 2N6049	26.5 29.5 19.5 2.5 3 1.5 3 1.4 1.7 29.9 39.9 44.9 1.9 1.9 21.5
MPSA42 MPSA55 MPSA55 MPSA63 MPSA63 MPSA92 MPF102 MPF105 MPF105 MPF109 MPSL01 MPSL01 MPSU02 MPSU02 MPSU02 MPSU02 MPSU02 MPSU02 MPSU02	1.20 1.00 1.00 1.00 1.00 1.00 1.00 1.20 .90 .90 .90 .90 1.50 1.75 1.90	2N5591 2N5641 2N5656 3N5770 2N5777 2N5830 2N5831 2N5873 2N5874 2N5945 2N5946 2N5961 2N6080 2N6080 2N6080	26.5 29.5 19.5 2.5 3 1.5 3 1.4 1.7 29.9 39.9 44.9 1.0 1.9 21.5 26.9
MPSA42 MPSA55 MPSA55 MPSA63 MPSA63 MPSA93 MPF102 MPF103 MPF105 MPF109 MPSL01 MPSL51 MPSU02 MPSU02 MPSU02 MPSU56 MPSU56 MPSU56 MPSU56 MPSU56 MPSU56	1.20 1.00 1.00 1.00 1.00 1.00 1.20 .90 .90 .90 .90 1.50 1.75 1.90 1.75 2.75	2N5591 2N5656 3N5770 2N5777 2N5830 2N5831 2N5873 2N5873 2N5944 2N5945 2N5946 2N5961 2N6027 2N6049 2N6083 2N6083	26.5 29.5 19.5 2.5 3.3 1.4 1.7 29.9 39.9 1.9 1.0 1.9 21.5 26.9 37.9
MPSA42 MPSA53 MPSA55 MPSA56 MPSA63 MPSA92 MPF102 MPF103 MPF105 MPF106 MPF106 MPSL01 MPSL01 MPSL01 MPSU62 MPSU52 MPSU52 MPSU52 MPSU52 MPSU52 MPSU52 MPSU52 MPSU52 MPSU52 MPSU52 MPSU52 MPSU54 MP	1.20 1.00 1.00 1.00 1.00 1.20 .90 .90 .90 .90 1.50 1.75 1.90 2.75 1.95	2N5591 2N5641 2N5656 3N5770 2N5777 2N5830 2N5831 2N5874 2N5945 2N5945 2N5946 2N5961 2N6049 2N6049 2N6080 2N6084 2N6084 2N6084 2N6122 2N6149	26.5 29.5 19.5 2.5 .3 1.5 .3 1.4 1.7 29.9 39.9 1.9 1.9 21.5 26.9 37.9
MPSA42 MPSA43 MPSA53 MPSA63 MPSA63 MPSA92 MPF102 MPF102 MPF105 MPF106 MPF109 MPSL01 MPSL01 MPSU02 MPSU02 MPSU02 MPSU02 MPSU02 MPSU02 MPSU03 MPF131 MPSU34 MP	1.20 1.00 1.00 1.00 1.00 1.00 1.00 90 .90 .90 .90 1.50 1.75 1.90 1.75 1.90 2.75 1.90 2.95 2.95 2.95 2.95 2.95 2.95 2.95 2.95	2N5591 2N5641 2N5656 3N57770 2N57777 2N5873 2N5877 2N5873 2N5874 2N5945 2N5945 2N5945 2N5945 2N5945 2N6027 2N6027 2N6083 2N6083 2N6084 2N6084 2N6085 2N6085 2N6085 2N6085 2N6085 2N6086 2N6086 2N6086 2N6086 2N6086 2N6086 2N6086	26.5 29.5 19.5 2.5 .3 1.5 .3 .3 1.4 1.7 29.9 39.9 44.9 1.9 1.9 21.5 26.9 37.9 1.9
MPSA42 MPSA43 MPSA55 MPSA63 MPSA63 MPSA63 MPSA93 MPF103 MPF105 MPF109 MPF109 MPSL01 MP	1.20 1.00 1.00 1.00 1.00 1.00 1.00 1.00	2N5591 2N5641 2N5656 2N5777 2N58777 2N5831 2N5873 2N5873 2N5874 2N5945 2N5945 2N5946 2N5961 2N6027 2N6029 2N6083 2N6084 2N6122 2N6122 2N6132 2N6133	26.5 29.5 19.5 2.5 .3 1.5 .3 1.4 1.7 29.9 39.9 44.9 1.0 1.9 21.5 26.9 37.9 1.9 1.9
MPSA42 MPSA43 MPSA56 MPSA63 MPSA63 MPSA63 MPSA92 MPSA92 MPF103 MPF103 MPF109 MPF109 MPF109 MPSL01 MPF109 MPSL01 MPF203 MPSU02 MPSU02 MPSU03 MPSU04 MPSU05 MPSU05 MPSU06 MPSU06 MPSU06 MPSU06 MPSU07 MPSU07 MPSU07 MPSU08 MPSU08 MPSU08 MPSU08 MPSU08 MPSU08 MPSU09 MP	1.20 1.00 1.00 1.00 1.00 1.20 .90 .90 .90 .90 .90 1.50 1.75 2.75 19.50 29.50 53.50 37.00	2N5591 2N5641 2N5656 3N5770 2N5777 2N5830 2N5873 2N5873 2N5874 2N5944 2N5945 2N5946 2N6027 2N6027 2N6083 2N6083 2N6083 2N6083 2N6084 2N6122 2N6133 2N6133 2N6133 2N6133	26.5 29.5 19.5 2.5 .3 1.5 .3 1.4 1.7 29.9 39.9 44.9 1.0 1.9 21.5 26.9 37.9 1.9 1.9
MPSA42 MPSA43 MPSA55 MPSA66 MPSA66 MPSA63 MPSA65 MPSA92 MPF102 MPF103 MPF106 MPF109 MPSL51 MPSU52 MPSU52 MPSU52 MPSU52 MPSU53 MPSU52 MPSU53 MPSU52 MPSU53 MPSU53 MPSU53 MPSU54 MP	1.20 1.00 1.00 1.00 1.00 1.20 .90 .90 .90 1.50 1.75 1.90 29.50 53.50 37.00 12.50	2N5591 2N5641 2N5656 2N57770 2N57770 2N58370 2N5831 2N5837 2N5842 2N5944 2N5945 2N5946 2N5961 2N6049 2N6080 2N6080 2N6084 2N6122 2N6122 2N61323 2N61323 2N6256	26.5 29.5 19.5 2.5 3.3 3.3 1.4 1.7 29.9 39.9 44.9 1.0 1.9 1.9 1.9 1.9 1.9 1.9 1.9 1.9 1.9 1.9
MPSA42 MPSA43 MPSA56 MPSA66 MPSA66 MPSA92 MPSA93 MPF102 MPF103 MPF106 MPF109 MPSL01 MPF108 MPF109 MPSL01 MPSL01 MPSU02 MPSU02 MPSU02 MPSU02 MPSU03 MPSU04 MPSU56 MP	1.20 1.00 1.00 1.00 1.00 1.20 .90 .90 .90 1.50 1.75 1.95 1.75 1.95 29.50 53.50 37.00 12.50 19.50	2N5591 2N5641 2N5656 2N57770 2N57770 2N5777 2N5830 2N5831 2N5873 2N58673 2N5946 2N5946 2N5946 2N5946 2N5946 2N5946 2N6020	26.5 29.5 19.5 2.5 3.3 3.3 1.4 1.7 29.9 39.9 44.9 1.0 1.9 1.9 1.9 1.9 1.9 1.9 1.9 1.9 1.9 1.9
MPSA42 MPSA43 MPSA56 MPSA66 MPSA66 MPSA63 MPSA65 MPSA92 MPF103 MPF106 MPF109 MPF109 MPF109 MPF109 MPSL51 MPSU52 MPSU52 MPSU52 MPSU52 MPSU52 MPSU53 MPSU54 MP	1.20 1.00 1.00 1.00 1.00 1.20 .90 .90 .90 .90 1.50 1.75 1.75 2.75 1.95 2.95 37.00 12.50 12	2N5591 2N5591 2N5555 3N5770 2N5773 2N5873 2N5873 2N5873 2N5874 2N5944 2N5945 2N594 2N5	26.5 29.5 19.5 2.5 2.5 3.3 1.5 1.7 29.9 39.9 44.9 1.0 1.9 21.5 23.7 9.1 1.9 1.9 1.9 1.9 1.9 1.9 1.9 1.9 1.9
BD238 BD238 BD238 BD238 BD238 BD248 BD248 BD437 BD437 BD437 BD437 BD437 BD437 BD647 BB746 BF746	1.20 1.00 1.00 1.00 1.00 1.00 1.00 1.00	2 H3049 2 H304	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
		2N15591 2N15591 2N15565 2N15770 2N15770 2N15770 2N15870 2N15873 2N15874 2N15944 2N15945 2N15945 2N15945 2N15946 2N15945 2N1594 2N159 2N1594 2N1594 2N1594 2N1594 2N1594 2N159 2N1594 2N	26.5 29.5 29.5 2.5 3.3 1.5 29.9 44.9 1.9 1.9 1.9 1.9 1.9 1.9 1.9 1.9 1.9 1
	1.90	2SA683	1.5
MPF131 TIP31A TIP31B TIP31C	1.90	2SA683	1.5
MPF131 TIP31A TIP31B TIP31C	1.90	2SA683 2SC2028 2SC2029 2SC2166	1.5
MPF131 TIP31A TIP31B TIP31C	1.90	2SA683 2SC2028 2SC2029 2SC2166 2SC1730	1.5
MPF131 TIP31A TIP31B TIP31C TIP32A TIP32B TIP32C	1.90	2SA683 2SC2028 2SC2029 2SC2166 2SC1730	1.5
MPF131 TIP31A TIP31B TIP31C TIP32A TIP32B TIP32C	1.90	2SA683 2SC2028 2SC2029 2SC2166 2SC1730 2SC1969 2SC1973	1.5
MPF131 TIP31A TIP31B TIP31C TIP32A TIP32B TIP32C TIP41C TIP42A TIP42C	1.90	2SA683 2SC2028 2SC2029 2SC2166 2SC1730 2SC1969 2SC1973	1.5
MPF131 TIP31A TIP31B TIP31C TIP32A TIP32B TIP32C TIP41C TIP42A TIP42A	1.90	2SA683 2SC2028 2SC2029 2SC2166 2SC1730 2SC1969 2SC1973 VN88AF 2SC372 2SC495	1.5
MPF131 TIP31A TIP31B TIP31C TIP32A TIP32B TIP32C TIP41C TIP42A TIP42A	1.90 1.00 1.00 1.00 1.00 1.00 1.90 1.90	2SA683 2SC2028 2SC2029 2SC2166 2SC1730 2SC1969 2SC1973 VN88AF 2SC372 2SC495 2SC710D	1.5
MPF131 TIP31A TIP31B TIP31C TIP32A TIP32B TIP32C TIP41C TIP42A TIP42A TIP42C TIP49 TIP50 TIP53	1.90 1.00 1.00 1.00 1.00 1.00 1.90 1.90	2SA683 2SC2028 2SC2029 2SC2166 2SC1730 2SC1969 2SC1973 VN88AF 2SC372 2SC495	1.5
MPF131 TIP31A TIP31B TIP31C TIP32A TIP32B TIP32C TIP41C TIP42A TIP42A TIP42C TIP49 TIP50 TIP53	1.90 1.00 1.00 1.00 1.00 1.00 1.90 1.90	2SA683 2SC2028 2SC2029 2SC2166 2SC1730 2SC1969 2SC1973 VN88AF 2SC372 2SC495 2SC710D 2SC73 2SC900F 2SC900F	1.5
MPF131 TIP31A TIP31B TIP31C TIP32A TIP32B TIP32C TIP41C TIP42A TIP42A TIP42C TIP49 TIP50 TIP53	1.90 1.00 1.00 1.00 1.00 1.00 1.90 1.90	2SA683 2SC2028 2SC2029 2SC2166 2SC1730 2SC1969 2SC1973 VN88AF 2SC372 2SC495 2SC710D 2SC73 2SC900F 2SC945A 2SC1014	1.5
MPF131 TIP31A TIP31B TIP31C TIP32A TIP32B TIP32C TIP41C TIP42A TIP42A TIP42C TIP49 TIP50 TIP53	1.90 1.00 1.00 1.00 1.00 1.00 1.90 1.90	2SA683 2SC2028 2SC2029 2SC2166 2SC1730 2SC1969 2SC1973 VN88AF 2SC372 2SC495 2SC710D 2SC73 2SC900F 2SC900F 2SC945A 2SC1014	1.5
MPF131 TIP31A TIP31B TIP31C TIP32A TIP32B TIP32C TIP41C TIP42A TIP42A TIP42C TIP49 TIP50 TIP53	1.90 1.00 1.00 1.00 1.00 1.00 1.90 1.90	2SA683 2SC2028 2SC2029 2SC2166 2SC1730 2SC1969 2SC1973 VN88AF 2SC372 2SC495 2SC710D 2SC73 2SC900F 2SC900F 2SC945A 2SC1014	1.5
MPF131 TIP31A TIP31B TIP31B TIP32A TIP32A TIP32B TIP42C TIP42C TIP42C TIP49 TIP50 TIP53	1.90 1.00 1.00 1.00 1.00 1.00 1.90 1.90	2SA683 2SC2028 2SC2029 2SC2166 2SC1730 2SC1969 2SC1973 VN88AF 2SC372 2SC495 2SC710D 2SC73 2SC900F 2SC900F 2SC9017	4.9 1.5 3.9 3.9 4.9 6.3 3.9 1.9 2.9 1.9 1.9

2N5489	14.50
2N5590	26.50
2N5591	29.50
2N5641	19.50
SNECEC	2.50
2143030	2.50
2N5//U	.30
2N5///	1.50
2N5830	.30
2N5831	.30
2N5873	1.40
2N5874	1.70
2N5944	29.95
2N5945	39.95
2N5946	44 95
2015061	1.00
2140901	1.00
2N6027	1.00
2N6049	1.90
2N6080	21.50
2N6083	26.90
2N6084	37.90
2M5499 2M5591 2M5591 2M5641 2M5659 2M5671 2M5770 2M5770 2M5770 2M5873 2M5873 2M5873 2M5873 2M5873 2M5874 2M5974 2M	14.50 29.50 19.50 2.50 .30 .30 .30 .30 .30 .30 .30 .30 .30 .3
2N6125	1.90
2N6130	1.90
2N6133	1.90
2N6256	14.50
2N6259	13.50
2N6274	29.50
2N6378	4 90
2N6425	4.50
CHO4ZS	4.00
2M03/8	4.90
204602	150
23A003	1.50
2502028	3.95
2SC2029	3.95
2SC2166	4.95
2SC1730	1.95
2SC1969	6.30
2SC1973	3.95
2SA683 2SC2028 2SC2029 2SC2166 2SC1730 2SC1969 2SC1973 VN88AF 2SC372 2SC495 2SC710D 2SC73 2SC73 2SC900F	1.50 3.95 3.95 4.95 1.95 6.30 3.95 3.95 1.95 1.95 1.95
2SC372	1.95
2SC495	2.95
2SC710D	1.95
2SC73	1.95
2SC900E	1.95

SPECIALS!

8087-3 (4.77MHz) \$279
8087-2 (8MHz) \$399
8087-1 (10MHz) \$649
80287-3 (6MHz) \$499
80287-7 (8MHz) \$699
8087-3 (4.77MHz) \$279

SPO256A-AL2

SPEECH CHIP
Speech synthesiser chip, needs
programming to work.
19 10+ 100-

\$15.00 \$14.50 \$14.00

CTS256-AL2 SPEECH CHIP

Contains the code recognition circuit to enable the project to plug directly on to the printer port, or into an IBM PC.

\$27.00 \$26.50 \$26.00

41256-12

\$4.95 \$4.75 \$4.50

4164

\$2.95 \$2.75 \$2.50

27128

\$7.00 \$6.50

27512

\$29.50 \$28.50 \$26.50

CA3130E

\$1.95 \$1.75 \$1.50

6116LP-3

\$3.95 \$3.75 \$3.50

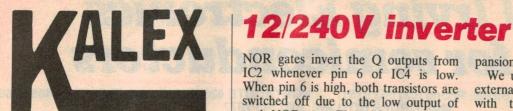
NE5534AN

\$1.85

INS8250

1-9 10+ 100+ \$24.50 \$22.50 \$20.50

AM 7910 (WORLD MODEM CHIP) \$24.95



UV MATERIALS

3M Scotchcal Photosensitive

	FUCK FILE		C CONTRACTOR CONTRACTOR
	250	× 300 mm	300 x 600 mm
8001	Red/Aluminium	\$70.15	\$80.75
8005	Black/Aluminium	\$70.15	\$80.75
8007	Reversal film	\$38.20	\$51.40
8009	Blue/Aluminium	\$70.15	\$80.75
8011	Red/White	\$63.20	\$72.70
8013	Black/Yellow	\$63.20	\$72.70
8015	Black/White	\$63.20	\$72.70
8016	Blue/White	\$63.20	\$72.70
8018	Green/White	\$63.20	\$72.70
8030	Black/Gold	\$88.90	\$108.00
8060	Black/Silver	\$63.20	\$72.70

UV PROCESSING EQUIPMENT KALEX LIGHT BOX

- Autoreset Timer
- 2 Level Exposure
- Timing Light
- Instant Light Up
- Safety Micro Switch
- Exposure to 22in × 11in

9.00

KALEX "PORTU-VEE"

- UV Light Box
- Fully Portable
- Exposure to 10in × 6in

199.00

PCB PROCESSING KALEX ETCH TANK

- Two Compartment
- Heater
- Recirculation (by Magnetic Pump)
- Two Level Rack
 Lid

RISTON 3400 PCB MATERIAL

SIZE	SINGLE	DOUBLE
INCHES	SIDED	SIDED
36×24	\$90.00	\$117.00
24×18	\$45.00	\$ 58.50
18×12	\$22.50	\$ 29.25
12×12	\$15.00	\$ 19.50
12×6	\$ 8.00	\$ 10.00

All prices plus sales tax if applicable



40 Wallis Ave. East Ivanhoe 3079 (03) 497 3422 497 3034 **Telex AA 37678**



ELECTRONIC COMPONENTS & ACCESSORIES SPECIALIST SCHOOL SUPPLIERS

NOR gates invert the Q outputs from IC2 whenever pin 6 of IC4 is low. When pin 6 is high, both transistors are switched off due to the low output of each NOR gate. Thus, IC4 controls the "dead" time of each transistor during every half cycle.

The resulting 240VAC waveform from the output of the transformer is shown in Fig.1.

So voltage regulation is obtained as follows: If the output from the transformer is too high, then the voltage at pin 3 of IC4 rises relative to the triangular waveform of pin 2 and this increases the "dead" time of the transistors.

If the output voltage drops, the voltage at pin 3 of IC4 is reduced relative to the triangular waveform at pin 2, reducing the "dead" time of the transistors and so increasing the drive to the transformer.

The gain of this feedback system is very high to keep the output voltage relatively constant. Note the $1M\Omega$ resistor between the non-inverting input and output of IC4. This in conjunction with the $6.8k\Omega$ resistor at the non-inverting input sets a small amount of hysteresis for IC4 to prevent high frequency oscil-

Power for the ICs is derived from the 12V supply and regulated using a 6.8V zener diode fed by the two 220Ω paralleled dropping resistors. The regulation isolates the ICs from the supply to the transformer to prevent false triggering. In addition, a 1000 µF capacitor connected to the positive supply of the transformer helps reduce the transients and supply drop as the transformer primary winding is switched on and off.

Construction

Our prototype inverter was housed in a case measuring 150(W) x 103(D) x 70mm (H) at back and 35mm (H) at the front. Most of the components are installed on a small printed circuit board (PCB) coded 87iv3 and measuring 97 x 58mm. The power switch and mains socket are mounted onto the top lid while the remaining components are mounted on the base of the case.

Start construction by installing the parts on the PCB. Make sure that all the diodes are oriented correctly and note carefully the diode to be used at each location. For example, diodes D7 and D8 are zeners and are different from small signal diodes D5 and D6. Zener diode D9 should have a stress relieving loop in the lead to allow for expansion.

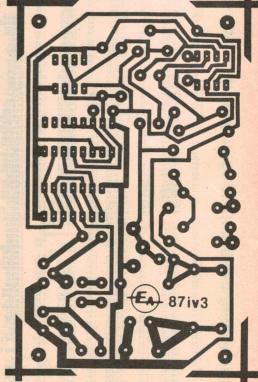
We used PC stakes to terminate the external connections since this helps with the wiring at a later stage.

Note that IC1 is oriented differently to the remaining ICs. The two electrolytic capacitors should be oriented as shown on the overlay diagram. The resistors and remaining capacitors can be inserted any way around.

The leads for the BUZ71 transistors should be bent so that the devices mount perpendicularly and to the left of the PCB. This will allow the transistors to be bolted to the side of the case for heatsinking.

Once the PCB is complete, work can begin on the case. The transformer mounts in the rear right hand side of the case (the deep end) to allow clearance for the lid. The PCB mounts close to the left hand side of the case and is mounted on 9mm standoffs.

If you have purchased a kit with drilled metalwork, some of the following steps will not be necessary. Otherwise, drill holes in the base of the case for mounting the PCB, transformer and earth lug. The holes for securing the transistors to the case can be drilled after temporarily mounting the PCB on the standoffs and marking the hole posi-



Above: full-scale artwork for the PCB.

PARTS LIST

- 1 PCB, code 87iv3, 97 x 58mm 1 sloping front metal cabinet, Jaycar Cat. No. HB-6080
- 1 Arlec 2155 transformer, 15V 1A centre tapped (or equivalent)
- 1 flush-mounting 3-pin mains panel socket
- 1 2A SPST toggle switch
- 1 cigarette lighter plug
- 4 12mm spacers
- 1 earth lug
- 1 cord clamp grommet
- 2 sets of insulating hardware for T0-220 package (mica washer, bush, screw and nut)

Semiconductors

- 1 555 timer IC
- 1 3130 CMOS op amp
- 1 4001 quad 2-input NOR gate
- 1 4027 dual J-K flipflop
- 2 BUZ71 SIPMOS transistors
- 4 1N4004 1A diodes
- 2 1N4148, 1N914 diodes
- 2 33V 400mW zener diodes
- 1 6.8V 1W zener diode

Capacitors

- 1 1000μF 16VW PC electrolytic
- 1 10µF 16VW PC electrolytic
- 1 0.12μF metallised polyester
- 1 33pF ceramic

Resistors (0.25W, 5%)

1 \times 1M Ω , 2 \times 470k Ω 0.5W, 1 \times 220k Ω , 1 \times 56k Ω , 2 \times 39k Ω , 1 \times 6.8k Ω , 1 \times 1.2k Ω , 2 \times 220 Ω 1W, 1 \times 50k Ω miniature vertical trimpot

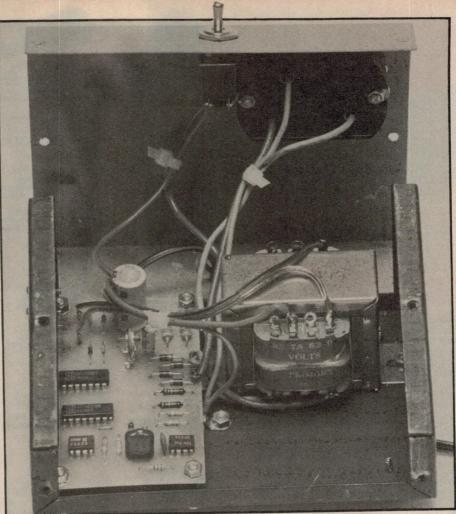
Miscellaneous

Screws, nuts, shakeproof washers, heatsink compound, solder, mains wire, cable ties, heavy duty hookup wire.

Holes are also required in the lid for the mains socket, power switch S1, and the cord clamp grommet. The mains socket mounts on the top of the lid very close to the front. It should be located as far to the front and as far to the right as possible without fouling the sides of the case. The switch mounts alongside the socket on the front of the lid. The cord clamp grommet mounts on the rear of the lid.

To make the round hole for the socket, drill a number of holes around the circumference of the required hole and knock out the centre piece. The hole can then be filed to a smooth finish. This done, bolt the transformer, PCB and earth lug to the case.

The two transistors must be insulated from the case using mica washers and



You will have to follow the layout shown here to get the parts to fit into the recommended case. Take care to ensure that leads carrying 240V AC don't short to adjacent connections.

insulating bushes. Smear heatsink compound on each of the mating surfaces before bolting the transistors to the case. This done, check that each transistor case is indeed isolated from the case by testing with a multimeter (switched to the "ohms" range).

Be sure to use mains-rated cable for the 240V wiring. This includes the leads from the 240V output of the transformer to the PCB and all leads to the mains socket. The earth wire should also be mains rated and should have the standard green with yellow stripe insula-

The remainder of the wiring can be run using medium-duty hookup wire. This wiring includes the leads between the low voltage terminals of the transformer and the PCB, and between the PCB and the switch. Figure eight twin cable can be used for wiring the ground and +12V wires to the cigarette lighter plug.

Once construction is complete check your work carefully for possible wiring errors. In particular, make sure that all the parts on the PCB are correctly positioned and oriented. It is also a good idea to recheck the isolation of the two switching transistors.

Testing

To test the inverter, connect a multimeter set to 1000V AC to the output socket and plug the inverter into the cigarette lighter socket of your car. Alternatively, you can use a 12V DC bench supply capable of supplying 2A. Measure the output from the inverter and adjust VR1 for a reading of 240-VAC.

You can test the regulation by connecting up your CD player and again measuring the AC voltage. It should still be very close to 240V AC.

Note that for accurate setting of the output voltage, it is necessary to use a moving iron meter or true RMS meter. However, for this inverter application, the actual voltage is not critical and a conventional analog or digital multimeter will be adequate.



HUNG CHANG (RITRON) 20 MHZ DUAL TRACE OSCILLOSCOPE

- Wide bandwidth and high sensitivity ●Internal graticule rectangular bright CRT
- Built in component tester
- Front panel trace rotater
 TV video sync filter
- Z axis (Intensity modulation)
- •High sensitivity X-Y mode
- Very low power consumption
- Regulated power supply circuit

COMPONENT TESTER is the special circuit with which a single component or components in circuit can be easily tested. The display shows faults of components, size of a component value, and characteristics of components. This feature is ideal to troubleshoot solid state circuits and components with no circuit power. Testing signal (AC Max 2 mA) is supplied from the COMPONENT TEST IN terminal and the result of the test is fed back to the second the second test is fed. test is fed back to the scope through the same test lead wire at the same time.

CRT: CRT: 6" (150mm) Flat-faced high brightness CRT with Internal Graticule. Effective display area: 8 x 10 div (1 div = 10 mm)

Acceleration potential: 2KV

Operating Modes: CH-A, CH-B, DUAL, ADD (CH-B can be inverted.)
Dual modes: Alter; 0.2ufs - 0.5ms/div. Chop; 1ms - 0.5s/div.
CHOP frequency 200KHz approximately.
Deflection factor: 5mV/div 20V/div +/-3%, 12 ranges in 1-2-5 step with fine

control.

Bandwidth: DC; DC - 20MHz (-3dB). AC; 10Hz - 20MHz - 3dB).

Rise Time: Less than 17ns.

Overshoot: Less than 3%.
Input Impedance: 1M ohm +/-5%, 20pF +/-3pF

Maximum Input Voltage: 600Vp-p or 300V (DC+AC Peak).

Channel Isolation: Better than 60 dB at 1KHz.

HORIZONTAL
Sweep Modes: NORMAL, and AUTO
Time Base: 0.2ufs - 0.5s/div +/-3%, 20 ranges in 1-2-5 step with fine control.
Linearity: 3%.

TRIGGERING

THIGGEHING
Sensitivity: INTERNAL: 1 div or better for 20Hz - 20MHz (Triggerable to more than 30MHz). EXTERNAL: 1Vp-p or better for DC - 20MHz (Triggerable to more than 30MHz). EXTERNAL: 1Vp-p or better for DC - 20MHz (Triggerable to Source: INT, CH-A, CH-B, LINE and EXT. Slope: Positive and Negative, continuosly variable with level control PULL AUTO for free-un.

Source: INI, LOTP.

Slope: Positive and Negative, continuosly variable wint level

AUTO for free-run.

Coupling: AC, HF-REJ and TV. TV SYNC Vertical and Horizontal Sync

Separator Circuitry allows any portion of complex TV video waveform to be
synchronized and expanded for viewing TV-H (Line) and TV-V (Frame) are
switched automatically by SWEEP TIME/DIV switch.

TV-V:0.5s/div to 0.1ms/div. TV-H:50ufs/div to 0.2ufs/div.

X-Y OPERATIONS
x-Y Operations: CH-A: Y axis. CH-B: X axis Highest Sensitivity: 5mV/div

COMPONENT TESTER
Component Tester: Max AC 9V at the terminal with no load. Max current 2mA when the terminal is shorted. (Internal resistance is 4.7K ohm)

OTHER SPECIFICATIONS

Intensity Modulation: TTL LEVEL (3Vp-p); Positive brighter.
BANDWIDTH; DC - 1MHz MAXIMUM INPUT VOLTAGE: 50V (DC+AC Peak)
Calibration Voltage: 0.5Vp-p+/-5%, 1KHz +/-5% Square wave.

Trace Rotation: Electrically adjustable on the front panel.
Power Requirements: AC, 100, 120, 220, 240V 20W
Weight: 7kg approximately.

Size: 162(H) x 294(W) x 352(D)mm.

Cat. Q12105

..... only \$849

(tax exempt only \$695)

Bulk orders, schools, please phone (03) 543 2166 for special low pricing











METEX 3800
MULTIMETER
This instrument is a compact, rugged, battery operated, hand held 31/20 digit multimeter for measuring DC and AC cottent. Resistance and Diode, for testing Audible continuity and transistor heE 1 no Dual-slope A-D community of the state of the

Oliote testing with 1 mA fixed current.
 Audible Continuity Test.
 Transistor hEE Test.
 SPECIFICATIONS
 Maximum Display; 1999 counts
 31/2 digit type with automatic polarity indication.

polarity indication.
Indication Method: LCD display.
Measuring Method: Dual-slope in
A-D converter system.
Over-range Indication: "1" Figure
only in the display.
Temperature Ranges: Operating
0-C to +40-C

0-C to +40-C Power Supply: one 9 volt battery (006P or FC-1 type of equivalent)

SAVES

MULTIMETER
This instrument is a compact, rugged, battery operated, hand held 3' 22' digit multimeter for measuring 3' 22' digit multimeter for measuring 3' 22' digit multimeter of measuring and a courrent. Resisting por and A' Capacitance. Transistor hTE and Capacitance. Transistor hTE and Continuity Test. The Dual-stope A-D Converter uses C-MOS technology for auto-zeroing, polarity selection and over-range indication. Full overload is provided. It is an ideal instrument for use in the field, laboratory, workshop, hobby and home applications.

Push-button ON/OFF power switch.

Push-button ON/OFF power switch.

Single 30 position easy to use

Push-button ON/OFF power switch.
Single 30 position easy to use rotary switch for FUNCTION and RANGE selection.

1/2" high contrast LCD.
Automatic over-range indication with the "1" displayed.
Automatic polarity indication on DC ranges.

with the Automatic polarity induces.
DC ranges.
All ranges fully protected plus Automatic "ZEFIO" of all ranges without short circuit except 200 ohm Range which shows "000 or 001" High Surge Voltage protection 1.5 KV-3 KV.
Capacitance measurements to 1pf

Audible Continuity Test.
 Audible Continuity Test.
 Transistor hFE Test.
 SPECIFICATIONS
 Maximum Display: 1999 counts
 31/2 digit type with automatic colarity indigation.

polarity indication indication Method: LCD display Measuring Method: Dual-slope in A-D converter system. Over-range Indication: "1" Figure only in the display. Temperature Ranges: Operating Oct 10 +40C. Power Supply: one 9 volt battery (006F or FC-1 type of equivalent) Cat. Q91540 SPECIAL \$109

Cat. Q91530

MULTIMETER

Normally \$109 SPECIAL \$79



CODE KEY PAD

Telephone type digital keypad. Four digit, changeable code. Over 5000 possible combinations Power consumption: 5mA standby

50mA alarm.

• Two sector LED and 1 arm LED.

Relay output.
Panic button.
Normally open tamper switch.
Dimensions: 145 x 100 x 37mm
ACP3 compatible.

SPECIAL, ONLY \$69.95

Wrong number lockout 12V DC operation.

DETECTOR
Compact P.I.R. with adjustable Compact P.I.F. with adjustable corner or wall mounting bracket, dual pyroelectric infra red sensing element gives a coverage 2 x 1 4 zones 2m high and 10m wide.

Sensitivity adjustment control

Detecting range 12-15 metres at 90 degrees

Detecting zones 9 long (up), 5 short (down)

LED indicator for walk test. (can be disabled)

LED indicator for waining disabled)
 Shielded against RF interference
 Shielded against RF interference
 Relay output NC or NO at 30V
 (AC-DC) 0.5 A max.
 Integral NC tamper switch
 Operating voltage 10.5 - 16V DC
 Current 20mA with LED 25mA
 S7????
 \$145



3M SCOTCHCAL PHOTOSENSITIVE

All prices per box and include tax 8007 REVERSAL FILM 250 x 300mm (10 sheets) ... \$39.95 300 x 600mm (5 sheets) ... \$54.95 8005 BLACK ALUMINIUM 250 x 300mm (10 sheets 300 x 600mm (5 sheets) 8009 BLUE ALUMINIUM 250 x 300mm (10 sheets) 300 x 600mm (5 sheets) 8011 RED/WHITE 250 x 300mm (10 sheets) 300 x 600mm (5 sheets) \$64.95 \$74.95 8013 BLACK/YELLOW 250 x 300mm (10 sheets 250 x 300mm (10 sheets) 300 x 600mm (5 sheets) 8015 BLACK/WHITE 250 x 300mm (10 sheets) 300 x 600mm (5 sheets)

8016 BLUE/WHITE

8018 GREEN/WHITE 250 x 300mm (10 sheets) 300 x 600mm (5 sheets) ARLEC SUPER TOOL
A versatile 12V electric tool for.
Sanding
Engraving
Grinding
Polishing
Cutting
Orilling
Milling
Milling
Erasing.etc.

UV EPROM ERASER
Erase your EPROMs quickly and safely. This unit is the cost effective solution to your problems. It will erase up to 9 x 24 pin devices in complete safely, in about 40 minutes (less for less chips). Features include:

• Chip drawer has conductive foam pad

Mains powered
 Mains powered
 Mains powered
 High UV intensity at chip surface ensures EPROMs are thoroughly erased
 Engineered to prevent UV exposure
 Dimensions 217 x 80 x 68mm
 MITHOUT TIMER

WITHOUT TIMER

WITH BUILT-IN TIMER

Special, \$89

Special, \$119

Cat. X14950

Features: Operates on safe, low 12 volts from mains electricity via AC adaptor (supplied). Light and easy to handle with touch switch and lock for continuous running. High torque motor. 10,000 R.P.M. Can drill 2mm holes in steel. 2 year guarantee

- holes in steel. 2 year guarantee Contents: 12V Super Tool Plugpack AC adaptor 1 spherical milling cutter 1 wire brush 1 grinding wheel 4 drill bits, 0.6, 0.8, 1.0, 1.2mm Set of 5 chuck collets 6 eraser sticks

struction sheets Cat. T12300 \$59.95



MASTER RACK MOUNTING CABINETS

These superb rack mount cabinets If the super rack mount cabinets will give your projects a real professional appearance! Just look at these features...

All dimensions conform to the International Standard

All aluminium construction

Choice of black or natural finish

Deluxe brush finish anodised front panel

Deluxe brush finish anodised ironipanel
 Removeable top and bottom lid
 Ventilated in a manual finish and selection of the selectio



W11260 14/.20 RED W11261 14/.20 BLACK W11265 14/.20 BLUE W11268 14/.20 WHITE PRICES PER 100 METRE ROLL 1-9

W11270 24/.20 RED W11272 24/.20 BLACK W11274 24/.20 GREEN PRICES PER 100 METRE ROLL 1-9

\$10.00

\$9.00

\$12.00

\$10.80

\$5.35

\$12.00

\$10.80

\$14.00

\$12.60

RECHARGEABLE 12V

RECHARGEABLE 12V
GELL BATTERIES
Leakproof and in 3 convenient sizes, these long service life batteries are ideal for burgular systems, emergency lighting or as a computer backup power supply. Ideal for many power needs.
Cat. S15029 12V 12 AH \$17.50

Cat. S15031 12V 2.6 AH \$32.50 Cat. S15033 12V 4.5 AH \$39.50



DIECAST BOXES

DIECAST BOXES
Diecast boxes are excellent to
RE shielding, and strength.
Screws are provided with each box.
H11451 100 x 50 x 25mm \$ 5.95
H11452 110 x 60 x 30mm \$ 6.50
H11451 120 x 65 x 40mm \$ 6.95
H11461 120 x 94 x 53mm \$ 11.50
H11462 188 x 120 x 78mm \$ 31.50
H11464 188 x 188 x 64mm ... \$29.50



BREADBOARD SPECIALS

Why pay more? Cat.P11000 100 holes Cat.P11000 100 holes \$2.75 Cat.P11005 640 holes \$13.00 Cat.P11007 640+100 holes \$13.00 Cat.P11009 840+200 holes \$13.00 Cat.P11001 1280+100 holes \$19.95 Cat.P11001 1280+300 holes \$19.95 Cat.P11001 1280+400 holes \$325.00 Cat.P11015 1920+500 holes \$75.50 Cat.P11015 1920+500 holes \$75.50 Cat.P11018 2560+700 holes \$64.95



WELLER WTCPN

- The WTCPN Features:
 Power Unit 240 V AC
 Temperature controlled iron, 24 V AC
 Flexible silicon lead for ease of
- T12500 R.R.P. \$149 SPECIAL, ONLY \$129



PANEL METERS GALORE

GALOREI
We have a great range of panel meters at great prices!
Cat.No.
Description
105500
MU45 0-1mA
12
105502
MU45 0-5A
12
105510
MU45 0-1A
12
105510
MU45 0-1A
12
105520
MU45 0-1A
12
105530
MU52 0-1A
14
105530
MU52 0-1A
16
105500
MU55 0-1DOUA
16
105500
MU55 0-1DOUA
16
105500
MU55 0-20V



DPM-200 PANEL METER

DPM-200 PANEL METER

Ultra Low Power

Separately Addressable
Annunciative

1 Samdag Reference
A low profile LCD DPM with a range
of useful symbols as shown. The
DPM 200 features 15mm 31/2 rigit
display, and ultra low current
consumption and a bandgap
reference for high stability. It also
features Auto-zero, Auto-polarity,
200m V Isal. It may be used in singleended, differential or ratiometric
modes. The 15sd can be easily
changed by the user to indicate any
other units. The decimal points and
symbols can all be driven from an
internal source. Wide supply and
symbols ource. Wide supply and
symbols ource. Wide supply and
internal source Wide supply and
internal source Wide supply rail
(5-15V DC) with mounting clips and
comprehensive data sheet. comprehensive data sheet.

SPECIFICATIONS:

SPECIFICATIONS:
Accuracy: 0.1% + -1 digit
Linearity: + -1 digit
Samples/sec: 3
Temp. Stability: 50 ppm typical
Temp. Range: 0. -50-C
Supply Voltage: 5 - 15V DC
Supply Voltage: 5 - 15V DC
Supply Current: 50uA typical
Max DC Input Volts: - 20V

\$99.95

Cat. Q15510















ROD IRVING ELECTRONICS N°1 FOR COMPONENT SPECIALS!



TAG TANTALUM



TRANSFORMERS

2155 240V 6-1: Cat. M12155		\$8.95
2156 240V 6-1 Cat. M12156		\$13.95
2840 240V 9V Cat. M12840		\$4.95
2851 240V 12- Cat. M12851		
2860 240V 15V Cat. M12860		
6672 240V 15- Cat. M16672	30V 1A ta \$14.95	pped \$13.95



QUALITY LEDS

Cat. No. Description	Price
Z10140 3mm Red	\$0.15
Z10141 3mm Green	\$0.20
Z10143 3mm Yellow	\$0.20
Z10145 3mm Orange	\$0.20
Z10150 5mm Red	\$0.15
Z10151 5mm Green	\$0.20
Z10152 5mm Yellow	\$0.20

HIGH INTENSITY

11		
Dimensio		
Overall: 63	mm across,	5mm high.
LEDs: 10)	5mm x 1mi	n
Cat.No.	1-9	10
	62 OF	627

LEDs: 10 x 5mm x 1mm		
Cat.No. Z10180	\$2.95	\$2. 75



1/2" HIGH INTENSITY

Dimensions:
Overall: 12.7mm across, 19mm high
Display: 12.7mm(H) x 7.3mm(W)
Segment Width: 1.2mm
Brightness: 3400 und 1 - 10mA

Overall: 12.7mm across, 19mm hig	h
Display: 12.7mm(H) x 7.3mm(W)	
Segment Width: 1.2mm	
Brightness: 3400 ucd. I _E = 10mA	
COMMON CATHODE	

COMMON CA	
Pin 1 Segment E	Pin 6 Segment B
Pin 2 Segment D	Pin 7 Segment A
Pin 3 CC	Pin 8CC
Pin 4 Segment C	Pin 9 Segment F
Pin 5 Segment Dp	Pin 10 Segment G
Cat.No. 1-9	10+ 100+
Z10190 \$1.95	\$1.75 \$1.50

COMMON ANODE

Pin 1 Sec	ment E	Pin	6 Se	gment B
Pin 2 Sec	ment D	Pin	7 Se	gment A
Pin 3 CA		Pin		
Pin 4 Sec	ment C	Pin	9 Se	gment F
Pin 5 Seg	ment Dp	Pin	10 Se	gment G
Cat.No.	1-9	1	0+	100+
Z10191	\$1.95	\$1	.75	\$1.50



SEMICONDUCTORS! Always check our prices before

you buy!			
	1-9	10+	100+
2716	\$9.95	\$9.50	\$8.95
2732	\$8.95	\$8.50	\$7.95
2764	\$7.95	\$7.50	\$6.95
27128	\$6.95	\$6.50	\$6.25
27256	\$11.50	\$10.50	\$10.00
4116	\$3.95	\$3.50	\$2.95
4164	\$2.95	\$2.75	\$2.50
41256	\$4.95	\$4.50	\$3.95
5558pir	\$0.50	\$0.40	\$0.35
6116	\$3.95	\$3.75	\$3.50
6264	\$6.50	\$5.50	\$5.25
6802	\$5.00	\$4.00	\$3.75
6821	\$2.00	\$1.80	\$1.70
6845	\$5.00	\$4.00	\$3.75
7406	\$0.40	\$0.30	\$0.25
8250	\$29.95	\$27.95	
NE5534AN			

SCOOP PURCHASEIII

1-9	10+	100+
\$1.95	\$1.85	\$1.75
WORLD	MODEM	CHIP
Cat. U216	14 Norm	ally \$49.50
Save \$2	5. SPECIA	L \$24.95

MEL9501

you blown up your Apple driv gging it in backwards or not SPECIAL, ONLY \$29.95

8087

Genuine Intel chips with mand data sheets packed in t	anual boxes!
8087-3 (4.77MHz)	\$279
8087-2 (8MHz)	\$399
8087-1 (10MHz)	\$649
80287-3 (6MHz)	\$499
80287-7 (8MHz)	\$699



(LOW PROFILE)

	ect Impo	ort" low prockets!	
1+		100+	1000+
8 Pin Ca	at.		
15c	14c	12c	09c
14 Pin C			
16c	15c	14c	10c
16 Pin C		SEE LINE	ENT.
17c		15c	11c
18 Pin (NVE S	
18c	STATE OF THE	16c	13c
20 Pin (
29c		27c	26c
24 Pin (00-	00-
35c		32c	28c
40 Pin (25-	30c
45c	4UC	35c	300



	E LED DEZ	
9mm hole	, available 3 co	lours
Cat.No.	Description	Price
S14030 Red		\$1.20
S14032 Gree	en	\$1.45
S14034 Yello	ow	\$1.45



MINI JUMPERS

Contact terminal: Phospor	bronze
Material: P.B.T. 94V-0	
Gold plated	The same

INSERTS	
or easy board	insertion.
10+	100+
\$1.40	\$1.35
	•
0	(40)
THE PERSON NAMED IN	
	or easy board 0 10+

CRYSTALS SPECIALS!
Description Cat.No. 1-9 10+
1MHz Y11000 \$7.50 \$7.00
4.433618MHz Y11025 \$2.95 \$2.75
8.867238MHz Y11055 \$2.95 \$2.75
12MHz Y11070 \$2.95 \$2.75
14.31818MHz Y11072 \$2.95 \$2.75

UNBELIEVABLE PRICE! \$0.50 \$0.45

\$0.40

6.35mm STEREO PLUGS

UNBEI	LIEVABLE PR	ICES!!
P10121 (pl	astic plug) Non	mally \$1.00
1-9	10+	100+
\$0.50	\$0.45	\$0.40



ULTRASONIC
TRANSDUCERS
Designed to transmit at 40kHz
(L19990) and receive at 40kHz
(L19991) with up to 20V I/P on the
transmitter. These units can't be
heard and so are ideal for TV remote
controls, water level detectors,
burgalar alarms, motion detectors
and information carriers as they can
be either pulsed or used in the
continuous wave mode.
Full specifications below for design
purposes.

purposes.

Maximum Input Voltage: 20V rms
Centre Frequency (kHz): 40 + -1.0
Sound Pressure Level 10V RMS:

110dB min. Sensitivity (dB/v/ubar) min.:

-65 min.
Bandwidth (kHz):
Transmit: 4.0 (at 100dB)
Receiver: 5.0 (at -73dB)
Impedance:
Transmit: 500
Receiver: 5000

Cat. L19990 (Transmitter) . \$4.75 Cat. L19991 (Receiver) \$4.75

10 AMP RELAY S.P.D.T. 12V Coil, 240V ... (S14114)

\$3.95

XENON/STROBE TUBES
As used in projects or as

TRIGGER TRANSFORMERS

\$4.95

Cat. S14050

\$3.75

\$2.95

\$1.45



CENTRONICS PLUG

SPECIAL!		
36 WAY	MALE (P	12200)
1-9	10+	100
\$3.95	\$3.50	\$3.0



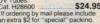
DB STAND OFFS

At incredible prices! No need to pay absurd prices because we import them direct and pass on

the savings to you!	
2 Pack P10930	\$1.00
10 Pack P10932	\$3.95
100 Pack P10934	20.00

U.V. TUBES

Fits into standard 15W flouro holder Suitable for Scotchcal, Eprom erasing etc. As used in ETI Eprom Erasing Kit Erasing Kit.
WARNING: Do not look directly into UV Tubes. Cat. H28600 \$24.95





SPECTROL MULTIDIALS MODEL 15-1-11

Number of turns: 10 Minor Scale Division: 1/500 turn Shaft Bore: 6.35mm (1/4") Finish: Satin Chrome Body Size: 25.4 x 44.45mm

(1 x 19/4") Depth: 25.4mm (1")	
Weight: 45.4g (1.6oz.)	CAE
Cat.R14405	\$45.

MODEL 16-1-11

Number of turns: 15
Minor Scale Division: 1/50 turn
Shaft Bore: 6.35mm (1/4")
Finish: Clear Anodize
Body Size: 22.2mm diameter (.875
Depth: 22.2mm (.875")
Weight: 19.89 (0.70z.) diameter (.875") \$26.95 Cat.R14400

MODEL 21-1-11

WUDEL 21-1-11
Number of turns: 15
Minor Scale Bytelion: 1/100 turn
Scale By

Weight: 85.g (3oz.) Cat.R14410 ...

\$46 95



SPECIALS!
We have just imported 50,000.
o you get to save a small fortun DB25 MALE (P10900)

\$1.50 \$1.20 \$1.00 **DB25 FEMALE (P10901)** \$1.70 \$1.40 \$1.20



S.P.D.T TOGGLES

we hav	e 15,000 to	
Cat.S11010	Nor	mally \$1.7
1-9	10+	100
\$0.80	\$0.75	\$0.6





heatsink suits most flat (plastic type) semiconductors, and has vertical

efficiency. Cat. H10602	Norr	mally \$1.25
1-9	10+	100+
\$0.65	\$0.55	\$0.50



UNIVERSAL HEATSINK

Universal because of the hole pattern which allows it to be mounted to most "power" type semiconductors. Features vented sides and black anodised finish for maximum efficiency. maximum efficiency.
Dimensions: 60(L)x35(W)x30(H)mm
Cat. H10601 Normally \$1.75



CONNECTORS SPECIALS

Cat. No. Description P10960 3 pin line Was \$3.90 NOW \$2.90 P10962 3 pin chasis Was \$3.00 NOW \$2 40 P10964 3 pin line fe NOW \$3.25

NOW \$3.45

P10966 3 pin chasis



BRIDGE SPECIALS

WO2 1A 20	OV Cat. Z110	30
\$0.30	\$0.28	\$0.26
	OV Cat. Z110	
\$0.35	\$0.30	\$0.28
SB604 6A	100V Cat. Z11	034
\$0.90	\$0.80	\$0.75



RCA GOLD PLATED PLUGS AND SOCKETS For those who need the ultimate in connection. Essential for laser disc players to get that fantastic sound quality.

Plug Cat. P10151

RCA GOLD PLATED CHASIS SOCKET For the ultimate connection! t. P10229 Normally \$1



UTILITY STORAGE CASE
A must for all electronic enthusiasts, technicians, hobbyists, fishermen and sewers! Features a clear plastic ids so you can tell at a glance the contents, and up to 48 adjustable compartments. A place for everything and everything in its place! Cat. H10090 \$19.95



MINI PARTS CASE

Features a clear plastic lid for easy identification of contents. Up to five adjustable lower compartments, plus a self elevating upper tray for

Cat. H10087 \$9.95



VIDEO RF MODULATOR
At an unbelievable prices! Our RF
modulators are channel selectable
either Channel O or Channel 1.
Cat. S16040
1-9 10+ \$3 95 \$2.95



Rod Irving Electronics

Mail Order and Corresponden P.O. Box 620, CLAYTON 2168 Telex: AA 151938



MAIL ORDER HOTLINE 008 335757

(TOLL FREE) CTLY ORDERS ONLY)

& INQUIRIES (03) 543 7877

\$2.00 \$49.99 \$3.00 \$50 \$99.99 \$4.00 \$100 \$199 \$7.50 \$200 \$499 \$10.00 \$500 plus \$12.50 FREE POSTAGE FOR ORDERS OVER \$75 & UNDER 3KG!! The above postage rates are assigned to the state of t

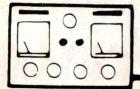
The above postage rates are for basic postage only. Road Freight bulky and fragile items will be charged at different rates.

Certified Post for orders over \$100 included free! Registered Post for orders over \$200 incuded free!

All sales tax exempt orders and wholesale inquiries to: RITRONICS WHOLESALE,







The Serviceman



There's no profit in crook joints

In spite of the vast improvement in component quality which has characterised the electronics industry over the last couple of decades, one consistently weak area remains. We've thrown away our paper capacitors, ditched our horrible carbon resistors, and banished our thermionic devices to the museum — all to good effect — but the faulty joint remains to harass, frustrate and impoverish us.

The truth is, the faulty joint is like no other fault. For one thing, finding such a fault seldom teaches us anything, for the simple reason that the chances of that particular fault appearing again in that model set are about one in a million. So, while the time wasted finding elusive faults involving specific components can usually be written off to experience — "I'll know that one when I see it next time" — time wasted finding a faulty joint is time wasted — period.

There is also the frightening realisation that the number of distinct faults and symptoms which the faulty joint can create is almost infinite. Look at any chassis, make any estimate you like as to the number of joints it contains, then try to visualise the likely symptoms which the failure of any one of them might produce.

Some could be relatively easy, like those causing total and permanent failure, but a significant number can create symptoms the like of which no-one has ever seen before. Then, to round off these pleasant thoughts, multiply that situation by the number of different models likely to pass across your bench in the course of a few months.

As I said: frightening.

Strange symptoms

Naturally, these philosophical musings were prompted by a couple of real life situations which caused me a certain amount of head scratching at the time. The first one, in particular, set me back because it produced a set of symptoms which I had never seen before and, I'm prepared to wager, have been seen by few, if any, of my readers.

I bet that'll get a bite!

The device in question was a National 48cm colour set and the story started

with a phone call from the lady of the house. She was not one of my regular customers but had been directed to me because I am authorised to service National sets under warranty, and this set was only a few months old. That much established I asked her to describe the set's behaviour.

"Well", she said, "the set went very well for the first few months, then occasionally the picture would suddenly contract and become small."

So what did she mean by "become small'? Was it loss of height? Loss of width? Or both? Exercising a certain amount of discretion I endeavoured to clarify these points. (It is easy to offend some people by questioning in a too abrupt manner. What seems like a reasonable question to us can often "throw" a customer, and get them offside.)

As it happened, the lady was anxious to be as helpful as possible and her description turned out to be quite accurate, even if I did have my doubts about it at the time.

"The picture appears in the top left hand corner and covers about a quarter of the screen. At first it happened only occasionally, but now it happens quite often. Oh, and another thing. There's no colour when this happens."

Well, that set me back on my heels for a few moments. So much so that I asked the lady to repeat the bit about the top left hand corner. But there was no mistake; that was what she meant. Then, as a final attempt to make sense of the description, I asked her whether the picture that appeared in these conditions was simply the top left quarter of the full picture, or was it a shrunken version of the whole picture. Again the lady was quite definite; it was

the whole picture squeezed into the top left hand corner.

Doing my best to keep the amazement, and even some incredulity, out of my voice I advised the lady that, under the terms of the warranty, it would be necessary to bring the set to my shop, to which she readily agreed. In any case, I didn't fancy tackling a set of symptoms like that in the customer's lounge room.

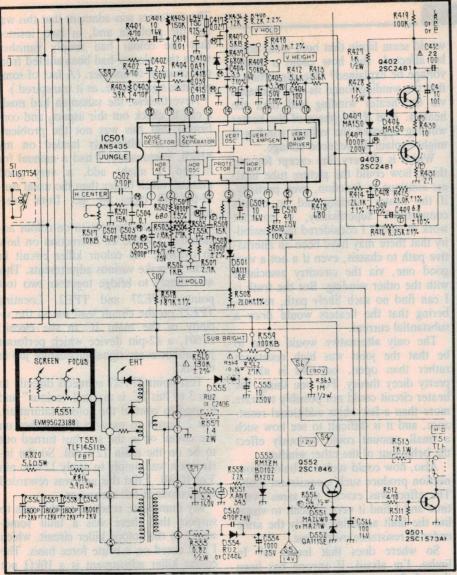
And so, in due course, the lady turned up with the set. It turned out to be a model TC-2035 which was the first setback because I realised that I didn't have a manual for it. This fact assumes some importance later on, not so much in regard to finding the fault, but in explaining the symptoms. However, more of that later.

I turned the set on as soon as the lady brought it in, but I need hardly add that it performed perfectly. The lady was somewhat embarrassed by this, and went to some lengths to assure me that the effect she described really did happen. I reassured her this situation was quite common, due to Murphy's Law. I'm not sure whether she really knew what I meant, but she seemed to accept my reassurance.

Naturally, the first thing I did was put in an order for a manual, but was advised that this might be delayed a few days, due to some kind of stock hassle. In the circumstances, there was little I could do except run the set, check the symptoms if and when they appeared, and perhaps make some preliminary tests which would hopefully prove pertinent when the manual arrived.

The fault appears

At least that was the theory: in practice it didn't work out that way. I left the set running and after a few hours the picture started to jitter slightly, as though it couldn't make up its mind what size it wanted to be. It then suddenly collapsed into the top left quarter of the screen, in monochrome, with the rest of the screen completely black, exactly as the lady had described. I offered a silent apology for any doubts I may have had in my own mind, and



Line output and horizontal and vertical oscillator circuitry for the National TC-2035.

reckoned I had now seen everything.

Quite obviously I didn't have a clue at that stage as to what could possibly cause such an effect, but I did have a gut feeling that it would involve the horizontal output stage in one way or another. There seemed little doubt that the scan was extending only halfway across the screen while, at the same time, the vertical stage was extending only halfway down the screen. And, since many of the operating voltages for the set would almost certainly be derived from the horizontal stage, a fault there could produce more than one symptom.

At least, that was the theory; I would need the manual to confirm it. In the meantime I decided to make whatever preliminary observations I could. The set was still in the cabinet at this stage—a deliberate routine on my part in case an intermittent is heat sensitive—

so I turned it off and withdrew it from the cabinet. And I need hardly add that, when I turned it on again, it was back to a normal picture.

I was still thinking in terms of the horizontal output stage, with the added possibility of a dry joint in that area. I set the chassis on its side and made a visual inspection of the suspect area, using a jeweller's loupe to examine each joint as closely as possible. But I found nothing suspicious; as far as I could see every visible joint was above reproach. So I switched the set on again and let it

To be honest, I wasn't persuing the fault very vigorously at this stage. I was waiting on the manual before getting stuck into it properly. On the other hand, intermittent faults need to be attacked as and when they appear so I decided to press on, at least superficially, whenever the fault appeared.

In fact, it showed up again a couple of hours later and I speculated as to whether I should go all scientific with meters and a CRO, or whether I should resort to the primitive and attack it with the butt end of a screwdriver. The absence of a manual decided me; I reached for the screwdriver.

Thus I began a systematic pattern of gentle tapping around the horizontal output stage. Nothing happened until I moved into the area of the line transformer when a moderately gentle tap suddenly brought the picture back to normal. I continued tapping in the hope that I might recreate the fault, but to no avail. Performance was back to normal and nothing was going to upset it. This turned out to be something of a pattern.

So the set was left running for the few remaining hours of the day, but without result. The next day it ran for a couple of hours then failed again. This time I went straight to the suspect area around the transformer, particularly where it was soldered into the printed board. I also reduced the vigour of the tapping, the better to isolate the sensitive area. Again, I was rewarded. A very gentle tap in one spot and the fault disappeared. But again, no amount of tapping, however vigorous, could recreate it.

In fact, there appeared to be only one way to produce the fault; simply let the set run for several hours until it made up its own mind. And so I went through the same routine several more times, except that I had replaced the screwdriver with a lighter, plastic alignment tool, and had reduced the tapping force to a mere flick and, eventually, simple pressure.

And this paid off. I narrowed the area down to a small group of line transformer pins where they were soldered to the copper pattern. Thus alerted, I went over them again with the jeweller's loupe, hoping to find some evidence of a dry joint or cracked pattern. But again, I drew a complete blank.

Nevertheless, I was highly suspicious of these few pins, and one in particular which was obviously a chassis connection. It looked perfect and so did the adjoining pattern, but I reasoned there was nothing to lose by unsoldering these joints and remaking them. So I reached for the iron and attacked the chassis pin.

And what a surprise! The solder came away from the pin so completely that it was obvious that it had never "wet" the metal in the first place. It had adhered to the copper pattern OK but, as far as the pin was concerned, it was as dry a

The Serviceman

joint as I have ever seen. Yet it was visually perfect. So much for the value of visual inspection; while useful, it can be misleading.

I remade the joint and then reconsidered whether I should check the adjacent pins at the same time. After some thought I decided against this, at least for the moment. I wanted to be sure that this fault was the one I was seeking, and not a red herring which Murphy had thrown in just to make it hard.

But that was it all right. The set ran all day for several days after that and never missed a beat. Comparing it with its previous performance I was convinced that I had found the cause. Thus satisfied, I went over the other pins with the iron, but found nothing suspicious.

And that, from a practical point of view, was really the end of the story. I called the customer, advised them it was ready, and it was duly collected. As with any intermittent fault, I impressed upon the lady, the possibility, slight though it was, that the fault may be laying dormant, and that she should contact me immediately at the first sign of repeat performance. That was several months ago and, at last check, all was well.

The explanation

But why did the fault cause the symptoms it did. The manual arrived about the time I was returning the set to the customer, and I gave the circuit only a casual glance. It wasn't until some time later that I sat down and studied it in detail in an attempt to make sense of the cause and effect. The faulty joint was on pin 1 of the transformer and provided the chassis connection for two windings; the winding supplying the picture tube heater (pins 1 and 9) and another low voltage winding (pins 1 and 4) providing, first, a 14V unregulated rail and, from this (via Q552 etc), a 12V regulated rail.

Now this poses a number of questions and I don't pretend to have the answers. At first glance it would appear that the failure of the 14V supply winding to connect directly to chassis might explain the reduced scan in both directions. Both the 14V rail and the 12V rail supply one of the main ICs (IC501) which contains both the vertical and horizontal oscillators and associated amplifiers.

So if this voltage was reduced — rather than removed completely — it

would seem likely that both scans could be affected. But how could a partial voltage be explained? One suggestion is that the winding found its way to chassis via the heater winding and then the heaters. And if the phase of the heater winding opposed the voltage winding it might explain the reduced voltage.

Which is all very fine except for one thing; how could the picture tube heaters continue to function, even partially, if the heater winding had no chassis connection? Superficially, it couldn't work at all but I considered the possibility that there may have been an alternative path to chassis, even if a not a very good one, via the circuitry associated with the other winding. But the truth is I can find no such likely path, remembering that the heaters would draw a substantial current.

The only alternative would seem to be that the joint was high resistance rather than open, but this is also a pretty dicey theory. For one thing, the heater circuit could not possibly tolerate more than a few ohms additional resistance, and it is difficult to see how such a small amount could seriously effect the behaviour of the other winding.

Also, how could such a nebulous connection produce such a consistant fault? The effect was exactly the same every time and I find it very difficult to visualise the fault assuming exactly the same order of resistance every time.

So where does that leave us? In limbo, I'm afraid. If anyone has been there before me, and can offer an explanation, I would be happy to pass it on. In the meantime, if ever I get my hands on that set again, or one like it, I have a feeling that I will be opening that chassis connection and making some pertinent measurements.

Another warranty job

My next story also involves a National 48cm set which was also still under warranty. But that's about where the similarity ends. It wasn't intermittent, and it was a relatively common "no colour" situation. The set came to me via a local retail outlet for whom I do warranty work, and the salesman advised me that the set was only a couple of months old.

His first reaction, when the customer complained, was to query the setting of the fine tuning control. This is a common cause of nuisance calls, particularly where there are children in the house who tend to fiddle with the controls.

The customer was adamant that this was not the problem and, in fact, insisted that the colour had simply vanished when the selector had been shifted from one channel to another. (A fact of some possible significance, as it transpired.)

Nevertheless, the salesman had made a call to check out this aspect, and confirmed that this was not the problem. So the set ultimately landed on my bench. Fortunately, I had a manual for it and, I might add, a very good manual; much better than the usual run-of-the-mill types we get from overseas.

Referring to the section on colour adjustment I found an instruction on how to override the colour killer circuit in order to make various adjustments. This was simply to bridge together two test points: TPE27 and TPE2. Locating TPE27 on the circuit lead me to the vicinity of the main IC in the circuit: IC601, a 42-pin device which performs just about every signal processing job in the set.

Test point TPE27 connects directly to pin 3 of this IC, is marked "colour" and is used to control the colour saturation. Pin 2 wasn't so easy to find, either on the circuit or in the set, but turned out to be on the main 12V rail. So the instruction was simply to apply 12V to pin 3 of IC601. I did this and was rewarded with colour at full saturation.

My immediate reaction to this was to suspect that there was a fault somewhere in the colour killer circuit, which I had cured on a brute force basis. The colour killer adjustment is a $10k\Omega$ pot (R616) between the 12V rail and chassis, with the moving arm going to the colour killer pin (pin 12) of IC601. Thus, this pin can be varied from zero to 12V but, according to the manual, normally sits at about 4.4V. In fact, it was virtually spot on.

So was there a fault in the chip, whereby the colour killer function was permanently locked on? With 42 pins involved I wasn't going to be panicked into any thoughts along those lines at this stage. Instead, I turned my attention to pin 3. It was all very well to brute force it with 12V but what were its normal operating conditions?

Tracing the circuit from pin 3 lead me to a $27k\Omega$ resistor (R619), then a long run to a 7-pin chassis socket, E12. This socket mates with a plug (E12 again) which connects via a cable to the "M-board". The M-board mounts behind the front of the cabinet and carries the tuner, with the channel selector buttons, and the other controls such as volume,

Weller Cordless Pyropen.

Portability, no power and no batteries, but with temperature controlled soldering, a hot air facility and a brazing torch for electronic, electrical, hobby and model work.

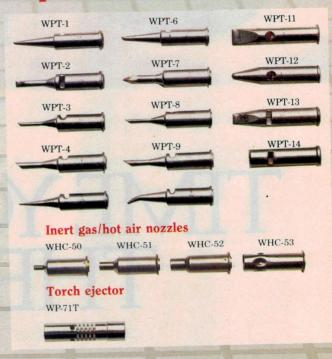
The Weller Pyropen is operated with butane gas and has been developed mainly for field and service jobs. The reservoir in the handle of the soldering pencil contains up to 27.5ccm of butane gas (as used in cigarette lighters) which is sufficient for 3-4 hours of soldering. Heat-up time is 30 seconds



The Pyropen also offers two typical Weller features - temperature control 200°-500°C by regulating the main valve. The temperature control and electrical neutrality make the Pyropen a versatile soldering tool for the most sensitive components.

WSTA3 Pyropen with standard "Longlife"-tip, $0\cdot13in/3.3mm$ width Hot air tip $0\cdot22in/5.7mm$ Ø Torch ejector Spanner Tool support clip Cleaning sponge Operation manual cooperTools

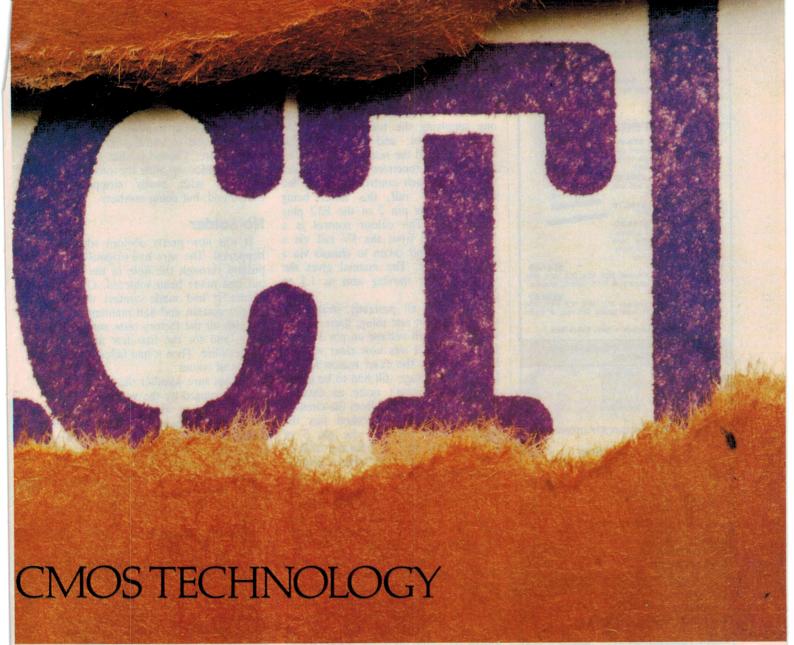
Tips and Parts







TIME YOU KNEW THE FACTS.



The most important advancement in CMOS logic has arrived. FACT.™ Fairchild's Advanced CMOS Technology. Nothing less than the highest-performance, full-featured CMOS logic line in the industry.

We've already defined over 60 different high-speed, ultra-lowpower devices, and 10 are available right now, right off the shelf. Representing a comprehensive, flexible product line designed to replace all other existing CMOS logic lines. Choose from gates, flip-flops, multiplexers, registers, buffers, multipliers, and much more. All from Fairchild. The only company that can give you the FACTs.

Speed-A good reason to explore the facts.

FACT is *the* logical replacement for LS, ALS, and HC/HCT technologies.

FAST (Fairchild Advanced Schottky TTL) and FACT (Fairchild Advanced CMOS Technology) are trademarks of Fairchild Camera and Instrument Corporation. © Copyright 1985 Fairchild Camera and Instrument Corporation.

The FACT family is manufactured using a sub-2-micron process. Making FACT parts the fastest CMOS logic devices anywhere. And they have lower gate delays than all other existing logic technologies.

Some more facts worth considering. Another reason for FACT's supe-

riority: ultra-low-power.

FACT parts draw two to three orders of magnitude less power than equivalent LS or ALS TTL devices only 100 µW/gate. Enhancing system reliability by reducing heat output. Eliminating costly regulated highcurrent power supplies. And allowing smaller equipment size.

What's more, FACT devices feature wider voltage specifications. Guaranteed worst-case DC/AC parameters. And dynamic output drive characteristics superior to the parts you're probably using now.

All of which adds up to the most efficient CMOS family ever assembled under one roof.

You can also get the facts fast.
The FACT family is compatible with members of our FAST™ family, for even easier system performance upgrades. For more information on the FACT family, call or visit your near-est sales office.

Melbourne: (03) 877 5444

FAX: (03) 878 4904

We're taking the high ground.

FAIRCHILD

A Schlumberger Company



We are stockists of Hitachi, Fluke, Trio, Goodwill, Meguro, Aaron and Kikusui: so if you're in the market for an oscilliscope, think of David Reid.

ESCORT MULTIMETERS

EDM 1105

\$78.89

18345

 3½ digits.
 Six functions: DCV ACV, DCA, ACA, OHM, Diode Testing.

0.8% basic DC accuracy.

EDM 1116 \$104.92 New model complete with transistor and capacitor tester.

EDM 1118 \$125.78 • 3½ digits with DB range

EDM 1125 \$113.95 3½ digits.
 Seven functions:
 DCV, ACV, DCA, ACA, OHM, Diode
 Testing, Audible Continuity.
 0.25% basic DC accuracy.

● 3½ digits. ● Eight functions: DCV, ACV, DCA, ACA. OHN 3½ digits.
 Eight functions: DCV, ACV, DCA, ACA, OHM Diode Testing, Audible Continuity.
 0.1% basic DC accuracy.

EDM 1346 EDM 1346

● 4½ digits. ● Eight functions: DCV, ACV, DCA, ACA, OHM Audible Continuity Testing, Diode Testing, Data Hold. ● 0.05% basic DC accuracy.

All multimeters + 20% Sales Tax

Ring us first for your 20 Meg. Oscilloscope enquiries!





FEATURES

Large 6 inch rectanglar internal graticule CRT

CH1 & CH2 ALT Triggering (Alternate triggering function)

High Sensitivity 1mV/div Hold-off function

TV Sync. Separation circuit

20% TAX CH1 Signal output

Plus 2 probes included in this deal.

Check out our kit range! Here's two to have a go at . **Megohm Meter**

It uses a transistor inverter to produce a regu-lated 1000V DC supply which is applied to the insulation under test. Insulation resistances be-tween 2M Ohm and more than 2000 Ohm can be measured. K 2500 (See EA July '85).



\$730.00

8 SECTOR ALARM SYSTEM KIT

Features:

• Alarm has 8 separate input circuits — 8

Alarm has 8 separate input circuits — 8 sectors can be monitored independently.
 Each input circuit is provided with an indicator LED and a sector 0n/0ff switch.
 Individual sector isolation allows the user to have some areas of the premises habited while others remain protected e.g. Inside Off/Outside On.

Inputs accept both normally closed and

Inputs accept both normally closed and normally open sensors.
Two inputs provided with an entry delay between 10-75 seconds).
Internal trip warning buzzer — alerts owner/occupant of pending alarm operation — great for the "forgetfu" amongst us. This buzzer is pre-settable between 5 and 55 seconds prior to Alarm.
Unique circuit detects automatically when any N/O or N/C loops are either open circuit or dead short. e.g. someone trying to bridge reer

dead short. e.g. someone trying to bridge reed

Switched output can be used to send a silent alarm through an auto-dialler circuit or similar

K 1900 (without Back up Battery)\$139.50 S 5065 (12V 1.2AH Backup Battery) \$22.95

These are just a few of the many 100's of up-todate Electronic items on display at



DAVID REID ELECTRONICS LIMITED

127 York Street, Sydney, 2000 or Telephone (02) 267 1385

brightness, contrast, picture, and the non-functioning colour control.

There were three cables altogether; one supplying the tuner, one for the volume control, and the E12 cable which provided the remaining functions. Each of these functions are voltage controlled and each control is a pot fed from the 5V rail, this latter being brought up via pin 2 of the E12 plug and socket. The colour control is a $10k\Omega$ pot fed from the 5V rail via a $1k\Omega$ resitor and taken to chassis via a 5.6k Ω resistor. The manual gives the voltage at the moving arm as 1.7 to 3.8V.

Which was all perfectly straightforward except for one thing; there was no sign of any such voltage on pin 3 of the IC601. While it was now clear why we had no colour, the exact reason for the loss of this voltage still had to be determined. This wasn't quite as easy in practice as it appeared from the circuit.

The first thing I checked was the $27k\Omega$ resistor adjacent the pin 3 of IC601. While not a common fault, I have had several cases where virtually brand new resistors have gone completely open circuit for no obvious reason; a nasty trap if you take them at their face value. In this case all was well; the resistor was intact, but there was no voltage on the other side of it.

The next check was the socket, E12, and its mating plug. There was no voltage here either, while a visual inspection — for what it was worth — failed to reveal any faulty connections to either device. So now it was a case of tracing the cable up to the M-board and it was immediately obvious that the only way to do this properly was to remove the board itself.

This was fairly straightforward, but involved undoing various nuts, screws, cable ties etc, which took some time. When it was finally freed I could see that the wires in the E12 cable — plus the other cables — were all terminated along the edge of the board by being fed through holes from the component side and then soldered to the copper pattern.

I checked the 5V rail as a matter of course, even though a failure here would have disabled the brightness, contrast, and picture controls as well as the colour. As I expected it was intact. What was more it was being applied to the $10k\Omega$ pot and appeared at the moving arm with approximately the range quoted in the manual. So where was it

going astray?

I traced the copper pattern down to the "M1" position on the edge of board - and looked in vain for the cable that was supposed to connect to it; it just wasn't there. I found it after a few moments, cabled up with the other wires, complete with neatly stripped and tinned end, but going nowhere.

No solder

It was now pretty obvious what had happened. The wire had originally been pushed through the hole in the board, but had never been soldered. Quite by chance it had made contact with the copper pattern and had maintained this through all the factory tests and inspections, and for the first few months of the set's life. Then it had failed, robbing the set of colour.

I'm not sure whether the original failure was caused by the wire coming out of the hole, or whether it was simply due to a slight movement. I suspect the latter and that it was my manhandling of the board which pulled it out. Recalling that the colour had vanished as the channel selector was being operated, it seems likely that this vibration was the last straw that broke the tenuous connection.

Naturally, the fault was easily fixed and, overall, it hadn't been that much of a hassle; at least the symptoms were conventional and consistent. But it had all taken time and the blob of solder which wasn't applied would turn out to be quite costly. And, I must confess, I found it quite surprising that such a fault could pass all tests and inspections and get into the field.

So there it is; a couple of faulty connections which caused quite a lot of inconvenience and expense. I wonder if we will ever solve this problem.

Finally, I expect that some of you are wondering about that "picture" control. This is a term somewhat loosely used, sometimes for the contrast control and sometimes for the brightness control. But since this set carries both these controls what does the picutre control do? It appears to be a video "sharpness" control which can vary the picture outlines from "hard" to "soft"

This is not a new idea. Some of the early European monochrome sets featured such a control. It was intended to provide a degree of high frequency boost in the video amplifier for use when the program material lacked sharpness; ie. poor quality films. On the

other hand, such boosting could lead to ringing on good quality program material, so the control was provided to allow it to be reduced.

Technically, the idea is quite sound but I do have doubts as to the average viewer's ability to use it intelligently. Having seen what most people do to contrast, brightness and colour setting, I hate to think what they could do with a control as subtle as this.

Still, it's a good idea for those who can manage it.

Squaring off

And now some more comments on the matter of wire sizes. I thought I had heard the last of this when I made some comments, and expressed some confusion, in the December notes. As it turned out, it seems that I upset Mr G.C. of Mt. Burrell, NSW, whose letter I quoted in those notes. The EA office has passed another letter on to me from this reader and he writes as follows.

I write in reference to the matter of naming wire sizes. Perhaps I am mistaken in my memory but in the letter to you I believe I wrote "10mm2". This is a recognised metric abbrieviation of "ten square millimetres", the unit being "mm2". The cubic unit is written "mm3".

This is the measurement system used throughout the electrical trade in reference to power transmission cables! I refuse to accept that the solar trade has formed "a cult".

What is this normal metric wire gauge 30 AWG = 10 thousandths of an inch diameter? This gauge system makes it necessary to have on hand a table to find the resistance of a cable. Yes I know a 10 AWG wire has a resistance of about one ohm per thousand feet and three gauge sizes alters this by a factor of two. However this seems unnecessarily clumsy when a simple formula exists as:

Resistance (ohms) = $\frac{length (m)}{area (sqmm)} \times 0.017$

or less accurately but more usefully: $R = L/A \times 1/60$

Furthermore, the gauge system becomes technically inappropriate for a multi-stranded wire.

There is somewhat more to G.C.'s letter, dealing with the metric system in general and, as nearly as I can make out, endeavouring to convince me that it is superior to the imperial system. (My apologies if I read you incorrectly,

G.C.). He finishes by suggesting that I need to study the metric system and also develop some humility.

Be that as it may, it would appear that, in summary, the following points need to be clarified:

(1) Whether the expression "mm²" is a recognised abbreviation for "square millimetres" and whether G.C. used this in his original letter.

(2) Whether electrical cables are now universally designated by area rather

than diameter.

(3) How did the AWG system get into this? (What's this Chinaman doing

in a Welsh pub?).

In regard to (1), yes G.C., you did use this expression in your letter and, OK, let's accept that it means "square millimetres" (Humble enough for you G.C., or must I prostrate myself and bash the skull three times upon the ground? If so, consider it done!)

But at least we are agreed on one thing; we are talking about "square mil-

limetres".

Item (2) is not quite so clear cut. Prompted by G.C.'s letter I wandered through the electrical section of a nearby large hardware store and took note of the labels on a wide range of cable drums, carrying various manufacturers' names. Strange to relate, with only one exception — which I will deal with in a moment — they all designated the cable size by diameter in millimetres in the first instance, but followed by an area value in brackets.

For example, what used to be 1/.004 (inch) lighting cable is now 1/1.13mm (1mm²), and what used to be 1/.064 power cable is now 1/1.78mm (2.5mm²). (These are not exact equivalents, but are very close.) These were by no means the only sizes in stock, which was quite extensive, but I quote them as being most familiar to readers.

Now maybe I'm biased but it seems to me that these several manufacturers prefer to use the diametric measurement as the primary one, with the area being provided purely as additional information which may be useful — even essential — in some circumstances. Nor is there anything new about this approach. For as long as I can remember the better wire tables have listed such additional data, including area, weight, turns per unit area, etc, to assist users with their design problems. (A typical example is the *Radiotron Designer's Handbook*, circa 1942).

Now what about the exception I mentioned. This presented the measurements in the opposite order; area first, with the diameter following in brackets.

But while this appeared to support G.C.'s approach, it was not this fact which really caught my attention. Far more important, I feel, is their manner of designating the area. I quote exactly from the label: "2.5mm sq. (1/1.78)"

Now I think even G.C. would have to admit that that description is mathematically incorrect. But, for the benefit of any readers who may have been lost along the way, let me spell it out. There is no way that a wire of 1.78mm diameter can have an area of 2.5mm square, ie. 6.25 square millimetres. In fact it will have an area of 2.5 square millimetres.

All of which seems to suggest that there is a certain amount of confusion in the trade and a need for them to get

their terminology right.

Incidently, I have raised this whole subject with several people in the trade and from what I can determine, the majority of electricians and not a few engineers regard "square millimetres" and "millimetres square" as meaning exactly the same thing. In fact, most of them tend to express the abbreviation "mm²", verbally, as "millimetres square" and, when tackled on the correctness of this, shrug their shoulders and claim "they both mean the same thing".

(Did I misinterpret G.C.'s abbreviation through ignorance, or was I simply

being hard to get on with?)

As to item (3) I must confess to being totally confused. Nowhere did I mention the AWG system and, while I am well aware that it provides a much more logical progression of sizes than the SWG system, I would never describe it as a metric system. When I mentioned the "normal metric system" I was referring to the metric system of wire sizes which, in fact, replaced the old B&S (AWG) and SWG system. A table listing these metric sizes and comparing them with the imperial systems was published in the 1976/77 EA Yearbook and is reprinted in the back of the Dick Smith Catalog.

And finally, G.C., if you are trying to convince me of the superiority of the metric system over the imperial system, forget it; you're about 50 years too late—in a manner of speaking. Suffice it to say that I was an advocate of the metric system long before the powers that were even thought about it. Moreover, I have had many a verbal fisticuff with those diehards and professional protesters who opposed its introduction. (Ask Mrs Serviceman!)

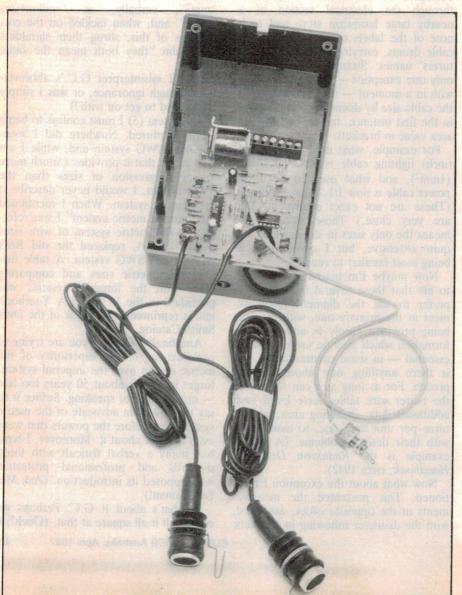
So that's about it G.C. Perhaps we could call it all square at that. (Ouch!)

Protect your home or car with this

Ultrasonic burglar alarm

Here is an inexpensive and self-contained ultrasonic burglar alarm which offers excellent performance for your car or home. It can be activated by either a mechanical switch or the remote control switch described in January.

by BRANCO JUSTIC



Ultrasonic movement detectors are not new — in fact, probably the largest percentage of all movement detectors are ultrasonic. When properly installed and adjusted they provide a reliable and cost-effective burglar alarm in most situations.

Apart from ultrasonic movement detection, this unit also has provision for "hard wired" switches, making it much more versatile. For example, in the case of a vehicle, switches which are operated by the bonnet, boot etc can be wired in, making it extremely difficult to break in without instantly setting off the alaim.

This alarm is designed to be activated by either a switch or, in the case of a wireless remote switch, by relay contacts. If a simple mechanical switch is used, it will have to be located outside the protected area in order to prevent false triggering when you want to go in or out.

Hidden switch or remote control?

For simpler installations, an effective and economical solution would be to have the required switch hidden out of sight. In a vehicle, the switch could be hidden in the boot, under the fenders, or behind a bumper bar. In the home, the switch could be hidden outside the protected area.

In both cases, several switches wired in series could be used in order to improve security, or you can use "barrel key" switches.

The car burglar alarm version was built into a plastic case and the ultrasonic transducers connected to the PCB via long shielded leads. The transducers are mounted on opposite ends of the car dashboard and can be clipped to the trim on the windscreen pillars.

A somewhat classier solution to the switch problem is to use a wireless remote control switch, such as the one described in the January 1987 issue. Note that there is sufficient space inside the plastic case of the alarm to accommodate the UHF Remote Switch circuitry. The resultant alarm system is very easy to install — only two connections have to be made to your car's electrical system (+12V and ground).

Let's now take a look at the circuit and see how the alarm works.

Transmitter

The transmitter section of the circuit is very simple and is based on CMOS inverter stages IC2c-IC2f. A three gate oscillator (IC2c-IC2e) is used to generate a 40kHz square wave at the output of IC2e. The frequency of operation is mainly determined by C10 and the total resistance of R18 and trimpot VR2. VR2 is used to adjust the transmitter frequency to exactly 40kHz.

The output of IC2e drives one side of the transducer (Tx) and inverter IC2f, the output of which drives the other side of the transducer. Thus, by adding IC2f, the drive voltage to the transducer is doubled. Capacitors C11 and C12 (100pF) equalise the loading conditions for the outputs of IC2e and IC2f and thereby ensure that they produce waveforms which are exactly complementary.

Receiver

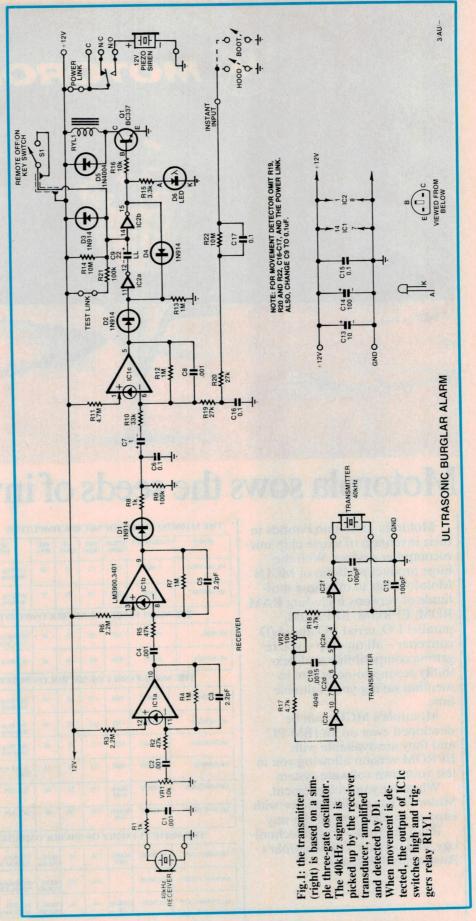
The 40kHz signal from the transmitter is picked up by the receiver transducer (Rx) and fed via a low pass filter section (R1, C1) to sensitivity control VR1. This allows the sensitivity to be adjusted to suit different applications. From there, the signal is AC-coupled via C2 and R2 to the inverting input of quad op amp stage IC1a. IC1 is a Norton amplifier, type LM3900 or LM3401.

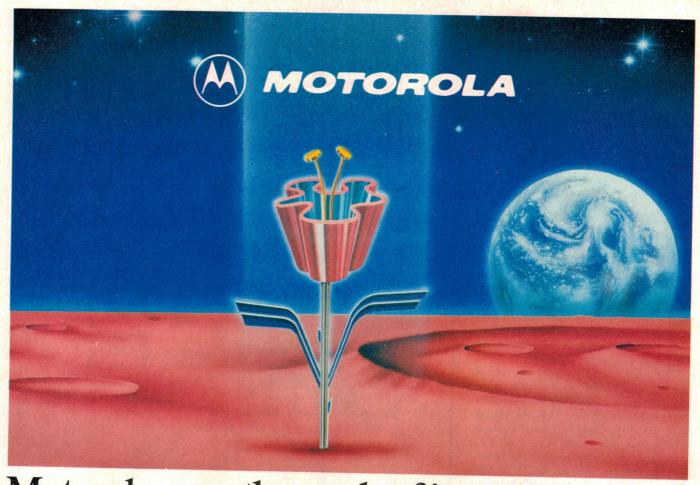
IC1a and IC1b form two identical amplifier stages, each having a gain of approximately 20 at 40kHz as set by R4/R2 and R7/R5. Thus, the overall gain is approximately 400. Capacitors C3 and C5 (in parallel with the feedback resistors) roll off the response of the amplifiers above 70kHz.

The amplified output signal appears at pin 9 of IC1b and is fed to a detector-cum-filter stage consisting of D1, R8, R9 and C6. Thus, in the absence of amplitude changes in the received 40kHz, a steady DC signal appears on

the positive terminal of C7.

If, however, there are sudden amplitude changes in the received signal (ie, when there is an intruder), the detector output level varies accordingly. These





Motorola sows the seeds of invention

Motorola knows no bounds in their invention of single chip microcomputer devices. With the huge product portfolio of MCUs Motorola has to offer in a multitude of versions including RAM, ROM, EPROM, EEPROM, parallel I/O, serial I/O and A/D converter – all on chip – you're getting compatibility and flexibility second-to-none, not to mention saving your valuable

Motorola's MCUs can be developed even on an IBM PC and they are available with EPROM version allowing you to test your own software system.

Whatever your requirement, Motorola has a wider choice with support to back you all the way.

Reap the fruits of high technology, and contact VSI-Motorola's Australian distributor.

THE M1468705 FAMILY OF MICE	ROCOMPL	TERS
-----------------------------	---------	------

DEVICE	TECHNOLOGY	EPROM (Bytes)	RAM (Bytes)	1/0 LINES	PKG PINS	SPECIAL FEATURES
MC1468705G2	CMOS	2106	112	32	40	Self Prog. Bootstrap
MC1468705F2	CMOS	1080	64	20	28	Self Prog. Bootstrap

THE M6801 FAMILY OF MICROCOMPUTERS

MC68701	HMOS	2048	128	29	40	SCI,MUX BUS Ext. Clock
MC68701U4	HMOS	4096	192	29	40	SCI,MUX BUS

THE M6805 FAMILY OF MICROCOMPUTERS

MC68705P3	HMOS	1804	112	20	28	Self Prog. Bootstrap
MC68705U3	HMOS	3776	112	32	40	Self Prog. Bootstrap
MC68705R3	HMOS	3776	112	32	40	Self Prog. Bootstrap
MC68705S3	HMOS	3600	112	20	28	A-D Converter SPI
MC68HC05C4	HMOS	Mask 4160	176	24	40	SCI, SPI
MC68HC05C8	HMOS	MASK 7700	176	24	40	SCI, SPI

THE M68HC11 FAMILY OF MICROCOMPUTERS

MC68HC11A8P	HCMOS	MASK 8000	256	38	48DIL 52QUAD	512 Bytes EEPROM, SCI, SPI
MC68HC11A8P1	HCMOS	-	256	38	48DIL 52QUAD	8KMonitor 512Bytes EEPROM
MC68HC811A2P	HCMOS	EEPROM 2K	256	38	48DIL 52QUAD	SCI, SPI A-D Converter



THE SOURCE OF MOTOROLA COMPONENTS

VSI Electronics (Aust) Pty. Ltd., 16 Dickson Ave., ARTARMON NSW 2064, AUSTRALIA. Telephone (02) 439 8622 Telex AA 22846 Fax (02) 439 6435

NEXUS 70/857

amplitude variations are coupled via C7 to low frequency amplifier stage IC1c, the output of which is normally biased low. This stage has a gain of approximately 30 and its output is used to trigger a monostable via isolation diode D2.

The monostable consists of inverter gates IC2a and IC2b and their associated components. The "on" time for the monostable, as determined by the values of R14 and C9, is approximately two minutes (no test link). When the test link is included, the "on" time is reduced to approximately one second.

The test link is used when adjusting the sensitivity of the unit during the initial installation. It reduces the waiting time between adjustments from two minutes to one second.

The alarm on-time (without the test link) can easily be extended or shortened by using a different capacitor value for C9 (RBLL or tantalum). For example, a $10\mu F$ capacitor gives an alarm time of one minute, while a $47\mu F$ capacitor gives an alarm time of four minutes.

Normally, C9 is charged to the positive supply rail and the output of the monostable (pin 15 of IC2b) is low. When an intruder is detected, pin 5 of IC1c goes high and pulls pin 11 of IC2a high via D2. Thus, pins 12 and 14 go low, pin 15 switches high, and the monostable latches up via D4.

C9 now charges towards the positive supply rail via R14 and, after about two minutes, pin 15 switches low again to turn the alarm off. This also effectively resets the alarm so that it will be instantly retriggered if further movement is detected. D3 is included to ensure that the input of IC2b can not go more than 0.6V above the positive supply rail.

The output from the monostable is used to operate a relay via R16 and



The alternative movement detector version was built into a clip-together plastic case from Dick Smith Electronics.

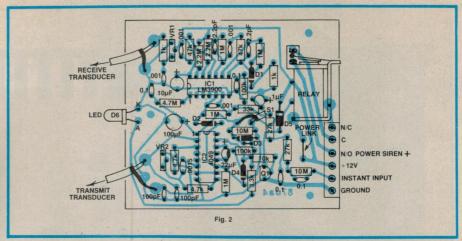


Fig.2: the parts can be installed in any order on the board but take care with the polarised components. Shielded cable is used to connect the transducers and the remote switch (or relay) terminals.

transistor switch (Q1). A LED indicator (D6) in series with a $3.3k\Omega$ resistor is wired across the monostable output to indicate the "alarm on" condition.

The alarm is turned on and off by a switch wired in parallel with the $10M\Omega$ timing resistor in the monostable circuit. When the switch is closed, pin 14 of IC2b is held high and thus Q1 and the relay are off. As mentioned previously, this switch may be either a keyswitch, a simple toggle switch or a set of relay contacts from the UHF Remote Switch.

Note that the on-board relay contacts of the UHF Remote Switch cannot be used directly as the project was originally described, since the relay wiper was permanenly connected to the +12V rail. Fortunately, this potential problem was recognised in time for the PCB to be modified such that all commercial versions of the board include provision for a power link (just like the present project).

So the solution is quite simple. If you want to use the relay contacts on your remote receiver to switch your ultrasonic alarm on and off, just delete the

power link on the receiver PCB. The on/off switch contacts of the ultrasonic alarm are wired across the normally open (N/O) contacts of the relay (ie, between N/O and COM).

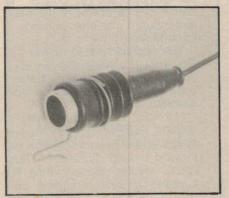
Finally, a normally open (N/O) instant trip input is coupled via C17 and a low pass filter network (R19, R20 and C16) to the inverting input of IC1c. Shorting this input to ground instantly triggers the alarm, so it is ideal for protecting the bonnet and the boot. R22 discharges C17 so that the alarm can be instantly retriggered from other instant trip inputs.

C17 ensures that the ultrasonic movement detection circuitry can retrigger the alarm regardless of the status of the instant trip switches.

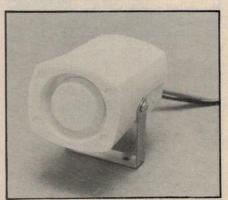
Construction

We built up two versions of the Ultrasonic Burglar Alarm, one for use in a car and the other for use as a movement detector to go with a home burglar alarm system.

Most of the parts are mounted on a printed circuit board (PCB) coded



The transducers are fitted into rubber spark plug covers. The wire clip enables attachment to the car windscreen pillars.



This compact piezoelectric siren can be hidden under the bonnet or inside the car and emits an ear-splitting modulated tone.

as soon as the Government completes its deliberations with all concerned parties.

While there has been no official government announcement, it is also intended that a 10-day week be introduced in 1988, leaving Sunday where it is. The new week would thus run Sunday, Monday, Blueday, Tuesday, Sicday, Wednesday, Pieday, Thursday, Friday and Saturday (alternatively, Sundie, Mundie, Bludie, Tuesdie, Wensdie, Piedie, Thursdie, Fridie and Satdie).

When this happens, the month will be deemed unwieldy and will be withdrawn.

A particular advantage with metric time is that there is no longer any AM or PM, so there can be no more confusion. The fortnight has been withdrawn. Provision for flexitime has been referred to a 10-member standing committee on which the ACTU will have representation.

Digital clock

Now all the above may be very straightforward but how do we now tell the time? That's where this new project comes into the picture.

In view of the fact that all existing clocks will be obsolete, we have decided to be the first with the introduction of a metric digital clock (or MDC). We're very proud of the device because its the first metric clock design that we know of. Let's take a closer look at this new marvel of logical thought processes.

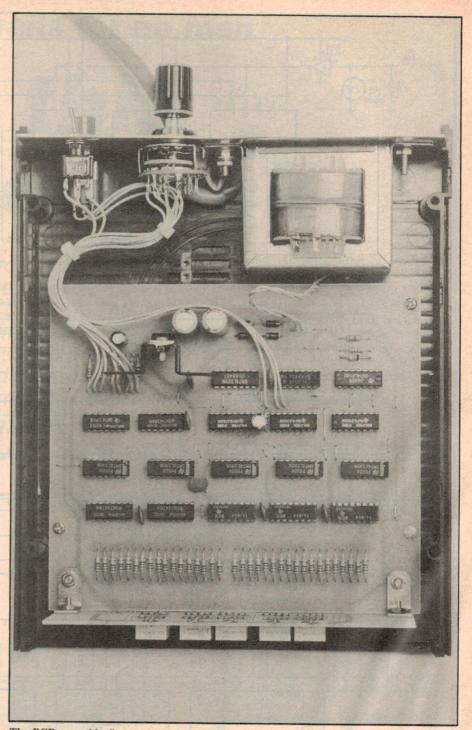
The first thing to note is that our new MDC has a 5-digit LED readout that counts up to 9 hours, 99 minutes and 99 seconds. The device is mains operated, is accurate to about ±5 metric seconds per metric day and should only take you about 1.26785 metric hours to build.

All controls are mounted on the rear panel. These consist of a Run/Halt switch, a Reset switch and a Pulse switch. All three are used for setting the time.

The prototype clock was designed and built by Dick Smith Electronics and they have a kit available at \$59.95.

The circuit

Fig.1 shows the circuit of the MDC. It can be broken into three sections: a power supply, a timebase divider (IC1-IC6), and a 5-digit decade counter IC7-IC18. The circuit uses lots of ICs for a very simple reason — proprietary LSI chips for digital metric clocks are not yet available! However the ICs specified can be easily purchased and are reasonably cheap.



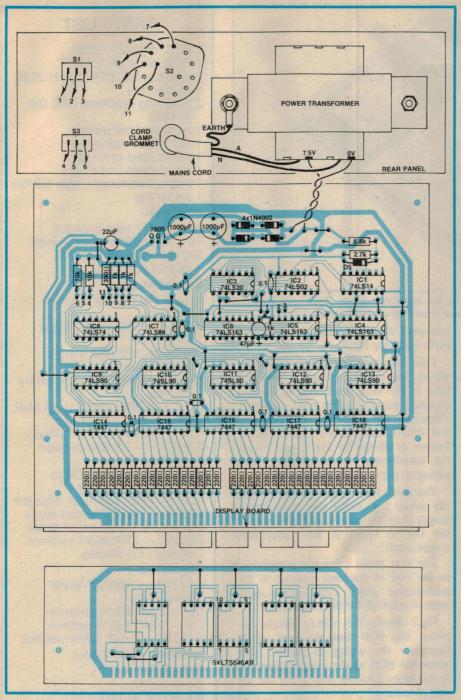
The PCB assembly fits neatly inside the DSE H-1895 instrument case. Note that the heatsink supplied with kit versions differs from that shown here and is soldered to the two holes in front of the regulator.

Power for the circuit is derived from the 7.5V secondary of mains transformer T1. Its output is rectified using diodes D1-D4 and filtered by two 1000μ F electrolytic capacitors (C1a and C1b). The resulting DC is then applied to 3-terminal regulator IC1 which provides a regulated +5V rail to power the TTL ICs.

The 9.5V secondary of the mains transformer also provides the timebase

signals for the clock. These pulses do not drive the counter circuit directly, however. Instead, the 50Hz mains pulses are divided by 43.2 to produce a 1.157Hz timebase so that the clock will correctly count in metric time.

This job is performed by the timebase divider circuitry which consists of ICs 1-6. The 50Hz mains pulses picked up from the transformer secondary are first attenuated by a voltage divider (R1,



You can mount the parts in any order on the PCB but take care to ensure that all polarised parts are correctly installed. The two PCBs are soldered together at right angles.

Where to buy the kit

This project was commissioned by the Research and Development Department at Dick Smith Electronics Pty Ltd. It is available as a kit of parts only and can be purchased by mail order or from your nearest DSE store.

The kit comes complete and includes fibreglass PCBs, predrilled metal-work, and screen-printed front and rear panels. The price is \$59.95.

Mail orders should be addressed to: Dick Smith Electronics Pty Ltd, PO Box 321, North Ryde 2113. Phone (02) 888 2105.

Note: copyright of the PCB patterns for this project is owned by Dick Smith Electronics.

R2) and then squared up by Schmitt inverter stage IC1a. Diode D5 clips the negative voltage swings of the transformer and ensures that the input to IC1a cannot go above 4.7V.

The output from IC1a is fed to the clock inputs of IC4 and IC5 which are 4-bit synchronous counters. These ICs, together with IC1b, IC2, IC3 and IC6, effectively divide by 43.2 to produce the desired 1.157Hz timebase at the output of NOR gate IC2a. It is this timebase signal which is used to drive the counter circuit.

ICs 9-13 are TTL decade counters arranged in cascade fashion to produce a maximum BCD count of 9.99.99. This is achieved by connecting the Q_D output of each counter to the A input (pin 14) of the following counter. Note that for ICs 9-11, the signal from the preceding counter is gated through an exclusive-OR (XOR) gate (IC7a,b,c).

The counters automatically return to 0.00.00 (ie, metric midnight) after the maximum count of 9.99.99 is reached. ICs 14-18 are BCD to 7-segment decoders which decode the counter outputs. These, in turn, drive the five common anode LED displays via current limiting resistors R10-R44.

Switches S1, S2 and S3 are for time setting. Normally, S1 is in the Run position to enable the timebase divider circuitry, while S2 can be in either position 1 or position 2. S3 is a normally closed (NC) pushbutton switch.

When S1 is set to Halt, the timebase is disabled and the display remains static. To reset the display to 0.00.00, the R0(2) input of each decade counter must be pulled momentarily high. This is done by setting S2 to position 3 and pushing Pulse switch S3.

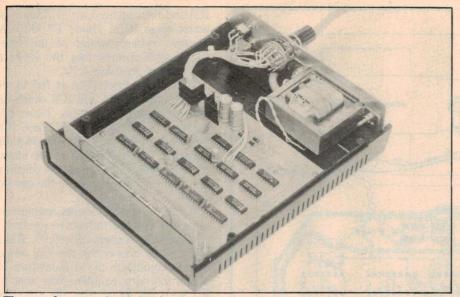
The hours, tens of minutes, and minutes are set by respectively selecting positions 4, 5 and 6 on S2 and repeatedly pushing S3. This clocks the A inputs of ICs 9-11 via the remaining inputs of the X-OR gates.

RS flipflop IC8 (74LS74) debounces the output of S3. Its Q output (pin 9) is normally low but goes high whenever S3 is pressed.

Construction

Most of the parts are mounted on a printed circuit board coded ZA-1555. A separate display board coded ZA-1556 accommodates the LED readouts and is soldered at right angles to the main board.

Begin construction by installing the parts on the main PCB as shown in Fig.2, but do not mount the regulator at this stage. The main thing to watch here



The transformer and switches are mounted on the metal rear panel. Take care with the mains wiring and make sure that the rear panel is earthed as shown in Fig.2.

is the orientation of the polarised components. These include the ICs, diodes and electrolytic capacitors.

Now for the regulator. Before mounting it on the board, it must first be bolted to its heatsink. This done, the assembly can be installed on the PCB as shown in Fig.2. Watch the orientation of the regulator — the metal tab goes towards the front of the PCB.

Note that the heatsink to be supplied with kits differs from that used in the prototype. It is soldered directly to the PCB via two mounting holes directly in front of the regulator.

The display PCB should only take a few minutes to assemble. Install the wire links first, then mount the five LED displays. Make sure that you install the displays the right way round, with the decimal point towards bottom right.

When the board assemblies have been completed, the two can be fastened together using the right angle brackets supplied with the kit. Next, carefully check that the solder pads along the edge of each PCB are correctly aligned. Adjust the two boards as necessary, then solder the matching pads together.

Hardware

The transformer and the three switches are all mounted on the aluminium rear panel of the case. In kit versions, this panel will be supplied predrilled and will feature screened lettering, so the job of mounting the hardware is really easy. Install the three switches first, then bolt the transformer into position.

Note that a solder lug must be secured under one of the transformer mounting nuts to terminate the mains earth lead (see Fig.2).

Take care when installing the mains wiring. The mains cord enters through a hole in the rear panel and is securely clamped using a mains cord grommet. Terminate the active (brown) and neutral (blue) leads directly to the transformer as shown in Fig.2, and sleeve the transformer terminals with plastic tubing to prevent accidental contact.

The earth lead (green/yellow) goes to the solder lug. Make this lead slightly longer than the others so that it will be the last to break if the mains cord comes adrift.

The rear panel assembly is mounted in the end of the case nearest to the loudspeaker grille. This ensures sufficient ventilation for the transformer.

Fig.2 shows the wiring details between the PCB and the rear panel. Complete the wiring as shown, then screw the PCB to the integral standoffs in the case. You are now ready for the smoke test.

Testing

Plug the clock into the wall, switch on and check for +5V at the output of the regulator. If this output is incorrect, switch off immediately and check for wiring errors.

Assuming all is well, you can now check the clock for correct operation. Set S1 to Run and S2 to position 1 (or 2) and check that the clock counts up correctly (it will initially display a random reading). The display should "freeze" when S1 is set to Halt.

Finally, check the timesetting switches (S2 and S3) for correct operation. First,

PARTS LIST

- 1 PCB, code ZA-1555
- 1 PCB, code ZA-1556
- 1 plastic case, DSE Cat. H-2520
- 4 rubber feet
- 2 mounting brackets, DSE Cat. H-1895
- 1 perspex front panel
- 1 aluminium rear panel
- 1 mains cord grommet
- 1 mains cord and plug
- 1 mains transformer, type M2155
- 1 solder lug

Switches

S1 — SPDT toggle switch

S2 — 6-position rotary switch

S3 — momentary contact pushbutton switch

Semiconductors

IC1 — 74LS14 hex Schmitt trigger

IC2 — 74LS02 quad 2-input NOR gate

IC3 — 74LS20 dual 4-input NAND gate

IC4-IC6 — 74LS163 4-bit binary counter

IC7 — 74LS86 quad 2-input XOR

IC8 — 74LS74 dual D flipflop IC9-IC13 — 74LS90 decade counter

IC14-IC18 — 7447 BCD to 7-segment decoder

IC19 — 7805 3-terminal regulator D1-D4 — 1N4002 silicon diode D5 — 4.7V 0.25W zener diode

D6-D10 — LTS546AR common anode LED display

Capacitors

C1a,C1b — 1000μF 16VW electrolytic

C2 — $22\mu\text{F}$ 16VW tantalum C3 — $47\mu\text{F}$ 6.3VW tantalum

C4-C10 — 0.1 µF 16VW ceramic

Resistors (0.25W, 5%)

 $R1-6.8k\Omega$

 $R2-2.7k\Omega$

R3, R5-R7 — $1k\Omega$

 $R4 - 390\Omega$

 $R8-R9 - 10k\Omega$

 $R10-R44 - 220\Omega$

set S2 to position 3 (Reset) and press the pulse switch — the display should reset to 0.00.00. It should now be possible to set the time by selecting the remaining positions on S2 and repeatedly pressing the pulse switch until the correct reading appears.

That's it — your metric digital clock is completed. Next April, we might describe a metric alarm to go with the new clock, but then again we might not.

PTYLTD

It's April! You'll think we're joking when you see this month's BARGAINS!! Get down to your local DSE store now



Matte Silver

Anti-glare silver paint for a smooth, elegant finish to that special project. Quick drying paint is ideal for front panels, cases, etc. 150g spray can. Cat N-1076

47 Was \$4.95

Nickel Screening Conductive Coatina

Electro-conductive spray turns plastic project boxes into electrically conductive surfaces. Ideal for RF screening and many other useful applications. Cat N-1049



Was \$27.50

Matte Black Spray Paint

A quick drying matte finish spray. Suitable for giving your project that professional finish.

VDX 1000 Videotext Decoder

Now you can have Videotext information in your home! Hundreds of pages of information can be viewed in a colour or monochrome TV! The Videotext computer bank. Once you become a registered user of the Videotext service you can assess one of the greatest libraries of current information available, news, entertainment, medical/legal advice, shopping, goods for sale, business information and much more! Normally you'd have to own a computer and expensive peripherals to access Videotext - but now, DSE makes it available to everyone! Cat X-9700



\$299





Magnavox World Receiver

Your passport to international entertainment. Tune into local AM, FM plus SSB and 11 SW bands.

 PLL for precise tuning • 16 preset memory function • Auto search • Direct frequency key in and triple speed manual tuning • Connections for antenna, headphones, DC and line out.

\$699 SAVE \$100



CHILLES P

Telephone-Type Cable 12 Conductor

Quartz controlled

The type of wire used by Telecom for telephone wiring. Ideal for intercoms or other multi-wire circuits Individually insulated and colour coded. Solid copper conductors,

Cat W-2140 \$1.55/m 100m or more \$1.40/m



High quality low loss TV coax, for low signal area installations. Air cored (dielectric), similar size to

750 cby 5C-2V 100m or more 68¢/m

Shielded Audio Cable Mono Light Duty

PVC covered, light duty, very flexible cable that is ideal for patch cords, small microphones, etc. Colour - grey.

Cat W-2030 45¢/M 100m or more 41¢/m

Giant Handbook of Electrical Circuits



Raymond A Collins — 880 pages Giant isn't the word: it's a whopping 880 pages! With 60 chapters covering everything from crystal sets to computer circuitry, you're sure to find what you want here! Cat B-1780

Was \$32.95

Marine

Radio

Australian

Handbook

This book will help boat owners

marine radio can be. Packed with all the essential details, here is a

book that will not only inform, but

can lead to lives being saved as

find out just how simple

well. Cat B-9604

Was \$1.95

choosing, fitting and using a

Manua

Cat B-1249

Was \$14.95



Design Of

PLL Circuits

A fascinating introduction to PLL

circuits: the theory, design and practical applications. Learn everything from the phase detector, voltage-controlled oscillator, to digital frequency synthesizers and more! Includes experiments to test your newly acquired knowledge. Over 250 pages by Howard M Berlin.

Evans & Jessop
This huge hard covered manual deals with the techniques and equipment applicable to frequencies above 30MHz with particular emphasis on microwaves. Cat B-2054

Australian Radio **Frequency** Handbook



This is the fantastic second edition of this best selling introduction to the fastest growing hobby in Australia today... scanning! This edition has not only been updated and revised where recessary, but it also contains hundreds of NEW frequency listings. Compelling reading! Cat B-9600

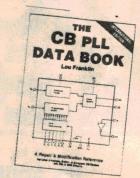
Was \$10.95

Active-Filter Cookbook

Everything you could possibly ever want to know about active-filters is in this book. From how to build an active filter, to the many different types available, and the one to suit your needs, etc... all of practical interest to the hobbyist and technicians. A wealth of information contained in 240 pages, by author Don Lancaster. Cat B-1250

Was \$26.50

CB PLL Data Book



A mine of information for the avid CB'er. Contains details on the phase locked loops used in the phase locked loops used in just about every CB ever made. So what? It also tells you how to modify the PLL circuitry to give more channels, to push it, repair it, to do just about anything except talk. (They're working on that one!) And if you repair CB's, this is indispensely for the this is indispensable for the technical data it gives - data you won't find anywhere else. Cat B-2326

Was \$18.95

Motorola **Small Signal Products** Databook

All the JEDEC types plus all of Motorola's "house" branded small signal transistors. Ideal companion. Cat B-4035

Was \$12.95

Was \$43.95

SAVE ON READING AT DSE!



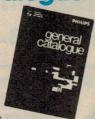


DESCRIPTION

LM335H Precision Temp Sensor TLC 251K Low Power Amp **DS557 Silicon Transistor** 74LS244 Low Schottky IC **DS547 Silicon Transistor** 2SC710 RF Signal Transistor 2N4427 RF Transistor 4116 Dynamic Ram TBA820M K 2W 8pin Audio Amp IC 2SC2694 RF Power Transistor LM394C Dual Dif Supamax — ½ price Voltage Regulator 5 volt 1 amp 41256 256K Dynamic Ram MRF660 RF Transistor 4528 10 IC CMOS

Cat No WAS NOW \$4.45 Z-6050 \$2.00 Z-6021 \$5.15 \$2.00 Z-1340 25¢ 15¢ Z-5294 \$2.75 \$1.50 Z-1300 25¢ 15¢ Z-2512 \$2.95 \$1.50 Z-2506 \$3.99 \$2.00 Z-9310 \$1.00 25¢ Z-2507 \$4.45 \$2.00 Z-2505 \$44.95 \$25.00 Z-6083 \$7.15 \$3.55 Z-6545 \$1.50 \$1.00 Z-9313 \$10.95 \$7.95 Z-2508 \$19.95 \$12.00 Z-5748 \$2.75 \$1.00

Phillips General Catalogue



568 pages.
Regarded by many (after Dick
Smith Electronics catalogue, of
course) as the "Bible" of the
electronics industry. If you
haven't got a late edition of the
Philips General Catalogue, you're
not in electronics!
Semiconductors, IC's,
components, materials and
electron tubes. Cat B-4010

Was \$13.95

\$697

Digital IC's & LED's



A superb source book for experienced hobbyists and novices alike! Teaches important fundamental circuit concepts, how to build useful digital devices, plus trouble shooting hints. Cat B-1785

\$4095

The World Transistor Cross-Reference Guide

A DSE Book Printed especially for Dick Smith Electronics, this book covers specifications for all major manufacturers and some minor ones as well. Invaluable! Cat B-4506

Was \$4.95

\$3

Magazine File



A hard spine magazine binder with metal rods for placement and protection of those valuable mags. Vinyl covered. Holds 12 issues (one year) of any mag to a maximum of 280mm high by 210mm. B-4045

Was \$8.95

\$447

Design of OP-AMP Circuits With Experiments



This is your opportunity to learn about the most versatile integrated circuit today: the Op-Amp. Renowned author, Howard M. Berlin, teaches you how to distinguish one type of op-amp from the other, about the use of op-amps in basic linear amp circuits, their use in active filters and more! Over 220 pages of information. Cat B-1251

Was \$22.95 \$4 696

Transistor Equivalents

This reference book enables the user to find substitutes for approximately 9,500 European, American and Japanese transistors. Cat B-4507

Was \$4.95

\$3

Laser Technology



Interested in laser technology?
This informative source book has been written for hobbyists and technicians. Covers laser radiation, construction, design and much, much more. Cat B-1861

Was \$12.95

\$8

Australian CB Radio Handbook

A complete guide to CB Radio including latest marine radio service details. Which system is best? What is the range of CB? What type should you buy? How to conduct yourself on air. The latest edition includes the new regulations and channel allocations. Cat B-2325



Was \$4.95

25

THE HARD WORD COSTS LESS

AT DSE WE'RE PLUGGED INTO THE HOBBYISTS NEEDS — AND SO WILL YOU BE!

	CODIDTION	Cat Na	WAS	NOW
DE	SCRIPTION	Cat No	WAS	HOM
Plu	g & Socket 9 pin valve	P-1910	\$2.65	\$1.65
	n Din Panel Socket	P-1562	95¢	65
	in Din Panel Socket	P-1522	55¢	356
	ket Bread Board	P-4616	\$34.95	\$26.95
	g & Socket Stereo Metal 2pin	P-1860	\$4.95	\$2.95
	ax Plug Plastic	P-2021	85¢	504
	ohm TV Coax Plug	P-2020	\$1.95	\$1.45
	A Plastic Plug	P-1420	55¢	304
	C Plug	P-2210	\$4.25	\$3.25
3.51	mm Stereo Plastic Plug	P-1140	95¢	656
	A Plastic Plug	P-1422	55¢	300
PLZ	259 UHF Line Plug	P-2310	\$2.35	\$1.50
Cor	nnector N Female Line			
(5	save \$5.00)	P-2405	\$7.95	\$2.95
	Pin DIL IC Socket — 1/2 price	P-4250	90	45
	ay Output Star Plug	P-1670	\$2.55	\$1.95

28 pin DIL IC Socket Relay Socket PCB Mounting 6 pin DIN Line Socket — ½ price Adaptor "F" Male to RCA Female — ½ price SO239 UHF Panel Socket 15 Pin D Type Plug Coax Joiner Adaptor UHF Joiner 36 way Amphenol (save \$4.00) 40 way DC Connector Card Edge (save \$3.00) RCA Line Socket Adapt 6.5 Stereo/Socket/6.5 Plug Q Range 2 Pin Chassis Socket Plug 2.5mm Power DC-2 Socket 3.5mm Inline Mono	
Socket 3.5mm Inline Mono UHF Tee Connector	

P-4245	75¢	50¢
P-4734	\$3.95	\$2.25
P-1564	\$1.05	50¢
1-1004	Ψ1.00	
P-2100	\$3.25	\$1.60
P-2340	\$1.95	\$1.50
P-2687	\$3.50	\$2.25
THE RESIDENCE OF THE PARTY OF T	STATE OF STREET	
P-2070	\$1.40	\$1.00
P-2380	\$2.85	\$1.85
P-2680	\$12.95	\$8.95
P-2762	\$11.95	\$8.95
P-1410	55¢	40¢
P-6580	\$1.65	\$1.25
P-3115	85¢	50¢
P-1645	70¢	50¢
P-1234	80¢	50¢
P-2384	\$4.95	\$3.95



You won't believe your luck! All this month we're being terribly foolish; with bargains galore — Hurry!! Get down to your nearest DSE store.

1200MHz Amateur TV Converter

This converter module is identical to those used in block type satellite TV receivers. Ideal for the reception of wide band signals. Can be connected directly to conventional TV set. Cat D-8310

\$5995

'Oskerbloc' VHF Power/SWR Meter

Oskerbloc — the world's most respected name in amateur circles — is available at DSE. It's a "must" for all VHF 2m enthusiasts. Ensures your antenna is working properly every time. Cat Q-1341

\$65 Save \$20

Oskerbloc's UHF Power/SWR Meter...

Performs the same super job on UHF antennae PLUS it's ideal for UHF CB. Cat Q-1342

\$99 Save \$46

.... and for HF users!



This Oskerbloc Power/SWR meter is just the thing... ideal for ALL SW bands. Cat Q-1340

\$99 Save \$70

GV-16 1.5W VHF Hand-Held Transceiver

Low priced, hand-held. But you don't lose on performance: It covers all 800 channels in the 144-148MHz band, with all the features like repeater splits, thumbwheel tuning, detachable antenna, built-in condensor mic, slider volume control and much, much more! Included NiCad. Cat D-3520



\$269

2 Metre 5dB Gain Mobile

Fantastic valuel 5.2 dB gain corrosion resistant stainless steel mobile antenna for the 2 metre band. Cat D-4320

\$7995

2 metre Yagi

Don't miss this! A 5 element 2 metre Yagi with gamma match at a DSE low price! Cat D-4705

\$5995

'Folded J' 2 metre Vertical

A huge price reduction! Easily installed 'Folded J' 2 metre base station antenna. Hurry, before they all go! Cat D-4211

\$4 995

FC-700 Antenna Tunei



Save over \$118.00! \$250

Match your transceiver and antenna perfectly! The FC-700 will give you the most from your "rig". Antenna matching can be as easy as turning a dial. Gives maximum power and maximum performance from your valuable gear! Includes large power/SWR meter, built-in dummy load AND covers all WARC HF bands. All this, and there's less than 0.5dB insertion loss! Cat D-2917

FRA-7700 Active Antenna

Fantastic! With the FRA-7700 Active Antenna you can pick up stations you didn't believe possible. Great for home unit dwellers! Cat D-2845

\$419 530 off!

Quality Yaesu gear at prices to clear!

Yaesu SP55 Mini Extension Speaker

Intended especially for communications use: transceivers, scanners, etc. Just 100 x 65 x 50mm (75mm high in mounting bracket supplied) and rated at 5W. Suits most transceivers (4 ohms imp) complete with 1.5m cable and 3.5mm plug. Cat D-2913

FRG-8800 DC Kit

Allows operation of your FRG-8800 on 12V DC. Great for field operation, monitoring, etc. Great value too! Cat D-2822

\$3 Save \$5.75!

Mobile Bracket

Oops! Over \$20 just fell off the price. Super convenient mobile bracket allows you to instantly connect your FT-290R for mobile use. Cat D-2911



\$40 save over

SB-10PTT Switch Unit

Suitable for both the FT-2700RH and the FT-270/RH, the SB-10 allows virtual hands-free operation with the headset earphone/microphone. A must for road safety! Cat D-3519

\$35 save over \$23

SAVE OVER \$201

BE QUICK!! THESE PRICES CAN'T LAST!
We've gone overboard
on amateur bargains!

The Cup may be over but at DSE we won't leave you high and dry. Before you go out on the water, check out our great value marine accessories!



5W/6 Ch "Bobcat"

Hand-held versatility you can count on at sea... and it's priced for every Salt! Boasts a full complement of the most wanted features: Hi-lo power input, Battery indicator, 6 channel capacity, 27.88MHz fitted — select remaining crystals of your choice. Cat D-1126

Even Measure Windspeed!



Now you can get an accurate measurement of true windspeed in the palm of your hand! Measures speed in knots, mph or metres/ second — and displays results on a 3 digit LED display. Complete with lanyard, pouch and comprehensive instructions. Cat Q-1405

Specifications:

Accuracy: normally 3% maximum (4% on "knots") Range: 99.9mph, 87.9 knots, 8790 feet/min, 44.8 m/s Size: 29.5 x 66 x 118mm

save \$30

Marine luxury at a bargain price. For safety there's access to all 55 international channels and instant CH-16 selection. Makes calls - via OTC's Seaphone - from your boat to the land phone network. Ideal for any Salt! DOC Approved



Check important lap speeds with DSE's economy stopwatch. Quartz accurate with split/lap times, normal time and day/date/month display.

AM/FM/CB/S

Top value for the avid radio listener - or the boat owner. You get 6 bands including all 40CB1 channels. Cat D-2832

- AM Broadcast Band
- FM Broadcast Band
- CB Band (26.94-27.46MHz)
- VHF Bands (59-218MHz)

\$20!

Shortwave Bands (3.9-12.5MHz)

volt AM/FM Cassette

An AM/FM cassette player complete with surface mount speakers. Cat A-6025



27MHz

Now: A whip antenna for glass, wood and cement boats. This helical antenna doesn't need a ground plane. Helical whip complete with mounting base, cable & simulated ground plane. Great value. Cat D-4070

Xtals for Hand Helds

Standard transmit/receive pairs for Standard traismit/receive pairs for the popular 27MHz marine channels 27.550 D-6055, 27.620 D-6062, 27.860 D-6086, 27.880 D-6088, 27.900 D-6090, 27.910 D-6091, 27.940 D-6094, 27.960 D-6096, 27.980 D-6098

AII \$950

HF Marine

Antenna to suit VHF Marine Transceiver (D-1400). Includes any-which-way base. Cat D-4016

38 Piece Deluxe **Repair Kit**

Everything for quick and easy wiring repairs — with no soldering! Here's what you get: • Multimeter • Crimp Tool • Pliers • 2 Screwdrivers • Neon Tester (rated to 500V) • Selection of crimp plugs. All in a handy, heavy duty carrying case! Cat T-4832

Was \$37.95

Now \$2995

Your boat needn't be a bottomless pit. DSE helps keep you afloat with quality, reliability and the LOWEST prices!

CB Price Compact CB big on Measures a mere 160 x 44 x 122mm. But it's big on features and performance!



Digital frequency display, variable squelch. ANL-Off. Digital signal/RF power meter and TX/MOD indicator. And more!! Cat D-1450

Save \$40 \$00

Heavy Duty

Save an amazing \$20!! A 27MHz

mobile antenna that's ideal for 4WD vehicles or anywhere the

going gets rough. Cat D-4078

Save \$20 \$

27MHz 100"

Base and Lead

High efficiency 27MHz Mobile

required

Mono Band RF Signalizer All Mode AM/FM/

Improve your signal! One touch Gain Attenuator spanning an incredibly wide range. Adjustable from Gain +20dB to Att. -25dB by simple knob operation.



3.27MHz Magnet **Base Antenna**

Centre loaded stainless steel construction with heavy magnetic base & 3.3m coax cable with PL- 259 plug. Cat D-4412

Save \$5

Antenna with heavy duty spring, base and supply lead! Save over Save \$10 \$



Full two way transmission and it fits into your pocket. A great gift for any child. Also ideal for the more serious use. Buy a few and start a spy ring! Complies with DOC. Specification RFME001

Cat D-1101 Save \$5

AM/FM/CB/SW/ Radio D.F.



Top value for the avid radio listener or the boat owner. This quality radio receiver has a built-in radio direction finder to pinpoint your position against AM radio stations. Plus you get 6 bands including all 40 CB channels plus shortwave AND VHF! And More! Cat D-2832

Save \$20!

Budget Price Pocket Size

This budget priced tester is a valued addition to any tool kit. The 3.5 digit LCD provides accurate readings at a glance. RF shielding ensures stable readings. Overload protected, all ohms ranges handle 250V AC or 350V DC indefinitely! Cat Q-1520

Free protective cover value \$10.95. Cat Q-1522

AF Signal

Square/Sine wave output audio signal generator, essential for work on huge range of circuits. With wide 20Hz-200kHZ output and high accuracy, it is the perfect partner for the RF generator. Cat Q-1310

Save \$30!

TOOLS

\$\$\$ Saver Sheet Metal Bender

Why buy instrument cases whey you can easily make your own with DSE's Sheet Metal Bender. You'll save \$\$\$ making your own heatsinks, RF shields, trays and covers. Provides a clean, smooth bend up to 90° on metals to 16 gauge. Pays for itself in no time! Cat T-5250

Save \$20! \$5 995 BH. Mg. M

Scope Cordless Solder Gun

For soldering where you want it, when you want it. Powerful enough to handle the same jobs as 60W mains irons, but inbuilt NiCads give you up to 100 solder joints. Includes plugpack. Heats in just six seconds. Supplied with charger, two spare elements and two spare bits.



Solder Stand with Magnifier

The helping hand when you need it most: when you have a "hot stick" in your hand! Heavy duty die-cast base, solder stand, clips for holding PD, etc - plus a unique magnifying lens for those close assembly jobs. Cat T-5710



Was \$19.95 \$4 595

Dual Trace 20MHz CRO

A professional standard 20MHZ oscilloscope! Bandwidth: DC to 20MHz (-3dB). Impedance: 1m ohm to 25pF

ohm to zspr +-2%. Algebraic addition: CHI+CHII, -CHI+CHII. Sweep time: 0.1us/DIV - 0.2s/DIV +/-3% (10°C - 35°C) steps in 1-2-5 sequence. And More!

Save \$100!

S/S Mini Needle **Nose Plier**

Precise, non-serrated tip and jaw. Ideal for use with semiconductors the very fine (1mm) tip will reach into places others won't. Cat T-3570



Hot Melt Glue Gun

Want to bond virtually anything to anything? You need a hot melt glue gun! It operates from mains power, heating the glue sticks to operating temperature very quickly. Pistol shape design for ease of use. Complete with mini stand. interchangeable tips. Free pack of twelve glue sticks to suit. Value \$5.45 Cat T-4840

Was \$16.95

Now

Spare Glue Sticks: pack of 12 sticks. Wide Nozzle: for large area gluing.

Cat T4842 \$4 99

38 Piece Deluxe **Repair Kit**

Everything for quick and easy wiring repairs. Ideal for automotive and hobby use. Here's what you get:

• Multimeter • Crimp Tool • Pliers • 2 Screwdrivers • Neo Tester (rated to 500V) • Selection of crimp lugs. All in a handy, heavy duty carrying case. Cat T-4832

Save \$10!

Baby Driver Set

Handy plastic wallet containing 5 of the most widely used drivers. Ideal for electronics, model makers, repairs, etc. Cat T-4340

Was \$8.45 Now

Push Button LCD Multimeter

Where else but DSE could you find a quality LCD multimeter at this incredibly low price. Features push button range selection, large 13mm LCD display, bench stand, diode check facility and overload protection. Cat Q-1444

Save \$30.

UP TO 50% OFF AND MORE!!

More Bargains!

Cable BNC to BNC for video W-1285 Was \$7.95 Now \$5.95 Universal Test Lead W-4528 Was \$19.95 Now \$16.95 Was \$19.95 Now \$16.95
PC board 12 x 12 bakelite H-5510
Was \$10.95 Now \$7.95
Draw component tray
(save over ½ price) H-2585
Was \$4.15 Now \$2.00
Tag 6 pole H-6626 Was 0.80 Now 0.50 Verner 6:1 ratio drives (½ price) H-3901 Was \$8.25 Now Now \$4.10 Tag 2 pole (½ price) H-6622 Was 0.85 **Now 0.40** Was 0.85 Now 0.40 Plastic instrument case 1/2 price) H-2525 Was \$37.95 Now \$18.95 Metal cabinet 102 X 56 X 83mm 1/2 price) H-2741 Was \$4.70 Now \$2.35 Tag 12 pole strip H-6712 Was \$6.95 Now \$4.95 Tag 4 pole strip H-6704 Was \$3.45 Now \$2.00 Tag 4 pole H-6624 Was \$1.25 Now 0.75 Heatsink 75m 2 x T0-3 H-3461 Was \$6.55 Now \$3.25 Instrument case 200 x 135 x 95 1/2 price) H-2506 Was \$14.25 Now \$7.12 33uF 10V electrolytic cap R-4330 Was 0.10 Now 0.01
Trimpot multiturn PC 100K R-1910
Was \$1.25 Now 0.75 Resistor pack 1% 300pc 1/4 watt R-7020 Was \$19.75 Now \$10.00 47uF 25V electrolytic cap R-4350 Was 0.35 Now 0.10
.047uF 100V green cap R-2080
Was 0.30 Now 0.10
40V RG 10000MFD electro (save nearly ½ price) R-4595 Was \$9.75 **Now \$5.00** Resistor pack 1% 300pc 1/4 watt R-7015 Was \$17.55 Now \$10 Pot-w/wound 6mm 3m Now \$10.00 200 ohm R-6911 Was \$4.10 Now \$1.00 1/4" pot carbon SG lin 500K ohm R-1812 Was \$1.20 Now 0.50 1/4" pot carbon SG lin Was \$1.20 100K ohm R-1824 Was \$1.30 Now 0.50 2.2uF 25V electrolytic cap R-4300 Was 0.30 Now 0.10

Half Price Cable

Mini twin heavy duty cable
(½ price of \$15 per roll) W-2012
Was 0.40 Now 0.20
SC2/A twin shield figure 8
(½ price or \$30 per roll) W-2036
Was 0.85 Now 0.40
Hook up wire 23/0.20 black
(½ price or \$10/roll) W-2262
Was 0.30 Now 0.15
Hook up wire 10 X 0.12 red
(\$5 per roll) W-2220
Was 0.15 Now 0.07
Hook up wire 23/0.20
(½ price or \$10 per roll) W-2260
Was 0.30 Now 0.15
Hook up wire black 10/0.254
(\$9 per roll) W-2242
Was 0.25 Now 0.12
Hook up wire green 10/0.12
(\$5 per roll) W-2225
Was 0.15 Now 0.07

Huge Hobbyist's \$avings We told you you'd be laughing!

Resistance Substitution Wheel

Convenient size with large, easy to read value selection that enables you to select values from 5 ohms to 1M ohm in 36 steps. Complete with leads and insulated crocodile clips.

\$4 295 Was \$16.95



LCD Multimeter Cap/Transistor Checker

The very latest — and the very best — digital multimeter. And multi is the word. Also checks capacitors PLUS transistors and diodes. It's got an audible continuity checker! Cat Q-1500



Moving Coil Panel Meter

A high quality moving coil meter with full scale accuracy better than 2%. Pre-calibrated; easily adapted to suit virtually any requirement! Cat Q-2020

Great Value!

Only \$895



Save over \$6!



Personal LCD with Auto Ranging

An amazing feature-packed 3.5 digit multimeter that's the size of a pocket calculator: only 10mm thick! It may be small but boasts a number of impressive features. Cat Q-1555

\$4995 Save \$10!



PTY LTD





Switch p/button SPST illum 12V yellow S-1523 Now \$10.95 Now \$10.95 Relay MHS4P 4PDT 185 ohm 12V S-7020 Was \$14.95 Now \$9.95 Switch ill p/button red S-1078 Was \$3.25 Now \$2.25 Switch ultra mini PCB 90° toggle S-1245
Was \$3.95 Now \$1.95
Switch waterproof Toggle S-1195
Was \$7.65 Now \$5.95
Switch mini p/button DPDT S-1220 Was \$4.95 Now \$3.45
Relay light DP (½ price) S-7304
Was \$24.95 Now \$12.47 12 V mini relay S-7112 Was \$4.95 **Now \$3.95** Switch slide SPDT (save \$1) S-2060 Was \$1.30 Now 0.30 Switch slide SP6T S-2050 Switch slide SP6T S-205(Was 0.95 Now 0.50)
Switch PCB mount SPDT (only 1¢ each) S-1950
Was 0.10 Now 0.01
Switch level action 4PDT (save \$1.50) S-1301
Was \$2.75 Now \$1.25 Switch u/mini PCB 90° toggle DPDT S-1249 Was \$3.25 Now \$1.25 Switch bank of 4 DPDT interlock S-1904 Was \$5.45 Now \$3.45 S/W mini toggle DPDT on/off S-1287 Was \$4.95 Now \$2.95 Switch mini toggle r/angle DPDT S-1177 Now \$1.40 Globe lilliput 6.3V S-3836 Was 0.55 Now 0.25
Switch single bank DPDT S-1906
Was \$2.45 Now \$1.00
Switch u/mini PC C/O
toggle DPDT (save \$2) S-1251
Was \$3.60 Now \$1.60 Holder fuse chassis PC mount (½ price) S-4258 Was 0.65 Now 0.32 Thermal fuse 250V 10A S-4490 Was \$1.35 Now 0.60 Globe socket S-3880 Was \$1.05 Now 0.60 Was \$1.05 Now 0.60 Switch u/mini p/button SPDT (½ price) S-1253 Was \$3.05 Now \$1.50 Bezel; u/MminiLED 2V green S-3529 Was \$1.85 Now \$1.00 Switch pull on/push off DC24V 1CA S-1190 Was \$4.50 Now \$3.00 Switch u/mini PCB 90° toggle SPDT S-1247 Was \$2.75 Now \$1.75 Plug & socket 9 pin valve S-1910 Was \$2.65 Now \$1.65 6 pin DIN panel socket S-1562 Now 0.65

2 pin DON panel socket S-1522 Was 0.55 **Now 0.35**



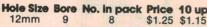
Metric Screw Packs

Description Asst P/H S/Tap Screws

Quantity Cat No Price 160pc H-1500 \$1.00 150pc H-1505 \$1.00

Grommets

Heavy duty grommets made of Black Rubber. Essential when cable passes through a metal chassis as they will prevent frayed cables and live chassis. Cat H-1719



All Ba

Brica Ch Ch Go Go Ho Liv Ma Mi Ne No Pai Per Rai Sy Tar



Insulated **Spacers**

The ideal spacer for insulating the chassis from your PC board. They come complete with screws. 25mm 4 H-1872 \$3,25 \$2,48



What a colourful idea! Now your projects can really look the part with these snazzy coloured knobs. Use them to colour code sections (great on multi-channel mixers, lighting consoles, etc). 16mm diam, standard metric (fluted shaft) fitting. Inserts can be changed to suit the occasion! Choice of four with-it colours. All one price:

each Orange Cat H-3802, Red Cat H-3800, Green Cat H-3806, Blue Cat H-3804.

Versatile Power Heatsink

The ingenious design of this heatsink makes it possible to mount it either flat on a panel, or at right angles to it (eg inside a case). The side fins also have tongue and groove so they may be joined sideways. Drilled version takes 2x TO-3's. Size is 78 x 110 x 33mm. Cat H-3460

Undrilled 1-4 \$6.36 ea 5 or more \$5.72 ea



Assorted Metric Screw Pack

Over 200 pieces of the most popular small sizes: M2.5, 3 and 4 nuts and screws - cross, round and countersunk head. Plated finish, ideal to have on hand in the workshop! Cat H-1680

STORE LOCATIONS

NSW
Swift & Young Sts.
T55 Terrace Level
Shop 1, 65-75 Main St
613 Princess Hwy
Oxford & Adelaide Sts
Shop 2, 1B Cross St.
Warringah Mall
Campbelltown Mall Queen St
Shop 235, Archer St Entrance
147 Hume Hwy
164 Pacific Hwy
315 Mann St
4 Florence St
Elizabeth Dr & Bathurst St
450 High Street
621-627 The Kingsway
173 Maitland Rd, Tighes Hill
Lane Cove & Waterloo Rds
George & Smith Sts
The Gateway High & Henry Sts
818 George St
125 York St
Treloar's Bldg, Brisbane St
263 Keira St

oury	(060)21	839
nkstown Sq	(02)707	
cktown	(02)671	
kehurst	(02)546	
ndi Junction	(02)387	
ookvale	(02)93	044

ookvale	(02)93 0441
mpbelltown	(046)27 2199
atswood Chase	(02)411 1955
ullora	(02)642 8922
re Hill	(02)439 5311
sford	(043)25 0235
rnsby	(02)477 6633
erpool	(02)600 9888
itland	(049)33 7866
randa	(02)525 2722
wcastle	(049)61 1896
rth Ryde	(02)88 3855
ramatta	(02)689 2188
nrith	(047)32 3400
lway Square	(02)211 3777
dney City	(02)267 9111
nworth	(067)66 1711
llongong	(042)28 3800
nongong	(042)20 3000

ACT
96 Gladstone St
VIC
Creswick Rd & Webster St
145 McCrae St
Shop 46, Box Hill Central, Main S
Hawthorn Rd & Nepean Hwy
260 Sydney Rd
1150 Mt Alexander Rd
Nepean Hwy & Ross Smith Ave
Shop 9 110, High St
291-293 Elizabeth St
Bridge Rd & The Boulevarde
Shop 2, 141 Maroondah Hwy
Springvale & Dandenong Rds
QLD
157-159 Elizabeth St
1001

166 Logan Rd
Gympie & Hamilton Rds
Queen Elizabeth Dr & Bernai
2nd Level Western Entranc
Redbank Shopping Plaza
Gold Coast Hwy & Welch S
Bowen & Ruthven Sts
Kings Rd & Woolcock St

4 1	
Fyshwick	(062)80 494
Ballarat	(053)31 543
Bendigo	(054)43 038
Box Hill	(03)890 069
East Brighton	(03)592 236
Coburg	(03)383 445
Essendon	(03)379 744
Frankston	(03)783 914
Geelong	(052)43 852
Melhourne City	(03)67 002

ichmond	(03)428 1614
ingwood	(03)879 5338
pringvale	(03)547 0522
risbane City	(07)229 9377
uranda	(07)391 6233
hermside	(07)359 6255

Hocknampton	(079)27 9644
Redbank	(07)288 5599
Southport	(075)32 9863
Toowoomba	(076)38 4300
Townsville	(077)72 5722

Cnr Pacific Hwy & Kingston Rd	Underwood	(07)341 0844
77 Grenfell St	Adelaide	(08)232 1200
Main South & Flagstaff Rds	Darlington	(08)298 8977
Main North Rd & Darlington St	Enfield	(08)260 6088
24 Park Terrace	Salisbury	(08)281 1593
Wharf St & Albany Hwy	Cannington	(09)451 8666
66 Adelaide St	Fremantle	(09)335 9733
William St & Robinson Ave	North Perth	(09)328 6944

66 Adelaide St William St & Robinson Ave	Cannington Fremantle North Perth	(09)451 8666 (09)335 9733 (09)328 6944
Raine Square, 125 William St	Perth City	(09)481 3261
Shop 40A, Lower Level		
Cat & Fiddle Arcade	Hobart	(002)31 0800
17 Stuart Hwy	Stuart Park	(089)81 1977

Visit our new Ringwood (Vic) store - now open at: Shop 2, 141 Maroondah Hwy. Ph: 879 5338

Dear Custom

Quite often, the products we advertise are so popular they run out within a few days, or unforseen circumstances might hold up shipments so that advertised lines are not in the stores by the time the advert appears. And very occasionally, an error might slip through our checks and appear in the advert (after all, we're human too!) Please don't blame the store manager or staff: they cannot solve a dock strike on the other side of the world, nor fix an error that's appeared in print. If you're about to drive across town to pick up an advertised line, why not play it safe and give them a call first... just in case! Thanks. Dick Smith Electronics

MAJOR DICK SMITH ELECTRONICS AUTHORISED RESELLERS

NSW:• Ballina: A. Cummings & Co, 91-93 River St, 86 2284 * Bowral: F.R.H. Electrical, 28 Station St, 61 1000 * Broken Hill: Hobbies & Electronics, 31 Oxide St, 88 4098 * Charlestown: Newtronics, 131 Pacific Hwy, 43 9600 * Coffs Harbour Electronics, 35 Talbragar St, 82 8500 * Coadord: Tomorrows Electronics, 247248 * Inveredit: Lyn Willing Electronics, 32 Lawrence St, 22 1821 * Leston: Leeton Record Centre, 124 Pine Ave, 53 2081 * Lightning Ridge: Lightning Ridge: Lightning Ridge Newsagency, 40A Morilla St, 29 5079 * Liamore: Decroin St, 247 1437 * Port Macquarier Hall of Electronics, Strong Centre, 124 Horton St, 83 7440 * Orange: Pice Electronics, 133 Summer St, 62 6491 * Springwood: Wellington's Pice Liamore: Decroin St, 247 1631 * Springwood: Wellington's Electronic Store S



Terms available to approved applicants

SA Customers: Credit facilities available through AGC: 10 Pulteney St, Adelaide

POST &

PACKING

CHARGES

ORDERS OVER \$75 FREE DELIVER

Order Value Charge \$5.00 - \$9.99\$10.00 - \$24.99 \$3.50 \$25.00 - \$49.99 \$4.50

Order Value Charge \$2.00 \$50.00 - \$75.00 \$6.50 \$75.00 or more N.A.







P.O. Box 321, North Ryde N.S.W. 2113 Tel: 888 3200

Offer concludes 30/4/87 or until stocks last. Prices can be increased without notice due to fluctuations in currency, high interest rates, government and imports.

50 and 25 years ago...

"Electronics Australia" is one of the longest running technical publications in the world. We started as "Wireless Weekly" in August 1922 and became "Radio and Hobbies in Australia" in April 1939. The title was changed to "Radio, Television and Hobbies" in February 1955 and finally, to "Electronics Australia" in April 1965. Below we feature some items from past issues.



April 1937

Oscillograph: We recently received for inspection the latest product of the Paton Electrical Instrument Company, namely, the highly interesting Model M1 "Palec" Cathode Ray Oscillograph, which incorporates the new one-inch 913 tube.

The specifications of the instrument as supplied by the manufacturers are as follows:

The instrument is equipped with hori-

zontal and vertical shifts to enable the picture to be positioned to any part of the screen. Focus and intensity controls are provided for sharp definition.

Both plates, horizontal and vertical, have independent amplifiers which enable very small EMFs to be viewed. These special amplifiers are "flat" from 50 cps to 100,000 cps.

Radio men go hunting: (caption) On a recent rabbit shooting trip — Ronnie Bell, of RCS Laboratories, tries to skin a rabbit whilst Rae Weingott of Kriesler, supervises the job.

Half-an-hour's hard work and you get one leg nearly out of the skin, and then appreciating the smell you throw the carcase away — that's how to skin a rabbit.



April 1962

FM Smokescreen: The very large group of listeners who were dismayed, some months ago, by the termination of FM broadcasting, ground their teeth in further frustration at a statement by the Postmaster-General, Mr Davidson, on March 8. Replying in Parliament to a question by Mr Enfield, the Minister said "... space would be made available in the ultra-high frequency band for a continuation of frequency modulation broadcasts, if a fairly general desire to have such a service reinstated were indicated by listeners generally . . . as yet I have not been informed of any such general desire."

What kind of double-talk is this? If only a fraction of those listeners who expressed their intention of doing so, actually wrote to their local member, then a very considerable number of letters must have reached Canberra. Did the Minister, by some strange circumstance, not hear of these letters or were

the people who wrote them written off as "hifi cranks" whose opinions didn't count?

Ultrasonic camera: Ultrasonics, that is sound of frequencies high above the range audible to the human ear, behave just like x-rays in that if they are made to pass through the human body they will produce a shadow pattern corresponding to areas of greater or lesser absorption by bone or soft tissue respectively.

This property has been put to use in an ultrasonic viewing device. In a tank full of water or other transfer medium a point source of ultrasonics, which is a single piezoelectric cystal, emits a beam of sound waves which pass through an object in the tank. They are then focussed by an acoustic lens to give an intensity distribution image on an electromagnetic transducer plate. This plate forms the end-window of a high-vacuum electron tube and is continuously scanned by an electron beam.

Applications suggested include biological studies, non-destructive testing of bonds between surfaces of various compositions, tests on resistance-welding and examination of materials which are highly absorbent to x-rays.

DEPARTMENT OF TECHNICAL AND FURTHER EDUCATION



TECHNICAL OFFICER (ENGINEERING)

GRADE 2, School of Applied Electricity Sydney Technical College Position No. 30/016 (Re-advertisement) \$24,440 range \$26,164 pa

Provide technical support to senior staff in the specification, assessment, prototype evaluation, sample testing and management of major plant requirements.

Essential: Qualifications and experience as outlined in the PSB Determination available from Inquiry Officer.

General Applicants may be required to undertake a test of proficiency.

Inquiries: Mr F. Nimmett, (02) 217-3680. Application forms can be obtained by telephoning (02) 219-9557 and (02) 219-9559, or by contacting your nearest TAFE college. Envelopes containing application forms should be clearly marked "Confidential" and forwarded to the Recruitment Section, Department of Technical and Further Education, PO Box K638, Haymarket 2000

APPLICATIONS CLOSE: 17 April, 1987.



The EP232 turns your PC or CPM computer into a versatile EPROM PROGRAMMER able to program all common EPROMS up to 27512.

- Software provided gives a comprehensive set of commands
- Simple interface via RS232 port
- TTL PROM programming modules available
- Locally made EP232 costs a fraction of imported programmers
 CALL FOR DETAILS Diamond Systems (03) 714 8269

P.O. Box 105 Hurstbridge 3099

Ultra D6000 CD player from Shure

For at least 50 years, Shure has been a manufacturer of fine magnetic cartridges and microphones and it continues to be so. But now it has moved into the digital age with the introduction of its own compact disc player which is a very refined machine indeed.

The Ultra D6000 is a fairly large machine, as CD players go, meauring 430mm wide, 75mm high and 325mm deep. Its mass is 5kg. As with the vast majority of hifi equipment today, the D6000 is finished in black with the control legends in gold. A good point here is that the labelling is quite legible which is a different story to some hifi equipment.

The display is a greeny-blue fluorescent panel which is also highly legible as well as being attractive. It displays the playing mode, time from the beginning of the program being played, the track number and index and the memory and repeat modes.

As far as the control features are concerned, the player itself is not overloaded with control buttons. Besides those for power and open/close buttons, it has buttons for stop/clear (clears memory), audible fast forward and reverse, skip forward and reverse, play/pause, repeat, A-B (for repeating a musical phrase) and memory (for programming). The remaining front panel

features comprise the headphone socket and associated level control.

On the rear panel, the D6000 has two pairs of RCA sockets, for the fixed and variable audio outputs. It also has a 5-pin DIN socket for video image subcode output, if and when this facility becomes available, plus a mains voltage selector.

Remote control

The deluxe feature of the D6000 is the comprehensive remote control. This actually provides more features than are available via the front panel controls. It has a numerical keypad to select track for immediate play or programming and it has two buttons for volume control. This last feature takes the D6000 into a very select group of CD players. The volume up and down buttons actually cause the front panel volume control knob to rotate clockwise or anticlockwise, respectively.

Using a mechanically rotated volume control in this way may seem a little inelegant but it is one way of being cer-

tain that the performance of the output amplifiers is not degraded by electronic volume control circuitry. In practice too, having the volume control visibly rotate is useful because it gives a simple and unambiguous indication of the volume setting, so that you do not blast yourself and your loudspeakers, or worse, your headphones.

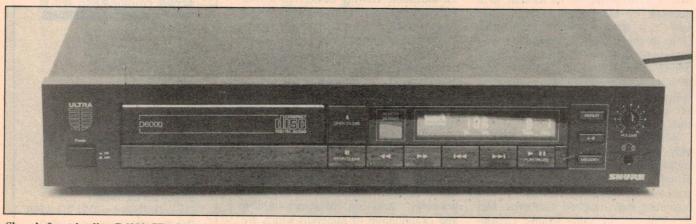
We found the remote control to be very effective, out to at least five metres from the machine. One could argue that it is not necessary to have the CD drawer open and close under remote control but what the hell, it stops you putting fingerprints on the player, doesn't it?

Inside the large chassis, the D6000 has one large printed circuit board and a number of smaller boards to accommodate the circuitry. One of those boards accommodates the motor-driven volume control.

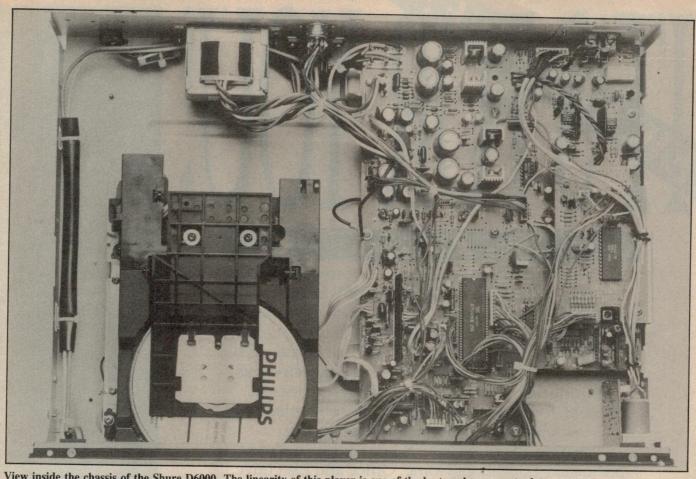
While manufactured according to Shure's specifications, the D6000 is made in Japan and the principal parts appear to be mostly sourced from NEC.

Shure's D6000 uses a 16-bit digital-toanalog decoder and two-times oversampling.

Interestingly, as with most Japanese-made consumer electronic equipment, the PC boards are single-sided instead of double-sided, use lots of wire links and have lots of interconnecting cables. Apparently, the Japanese take the attitude that this approach is cheaper and



Shure's front-loading D6000 CD player has infrared remote control of all functions, including volume.



View inside the chassis of the Shure D6000. The linearity of this player is one of the best we have seen to date.

more reliable than using the more elegant approach of double-sided boards with almost no additional wiring.

With the steady evolution of CD player design, it is apparent that the circuitry is becoming much simpler due to the increasing use of ever more complex VLSI chips. At the same time, the player mechanisms are becoming smaller, lighter and physically simpler. While this is happening, the operational aspects of the players are tending to improve.

The major improvements have been in the laser tracking which means that the later CD players are generally better in their handling of CD defects such as scratches, warps and eccentricity. These new players also are less susceptible to shock and vibration.

Shure's CD transport mechanism, which has a linear tracking laser pickup, is certainly elegantly simple in appearance. However, it has two mechanism locking screws which must be removed from the underside before the deck can be played. As we have remarked in previous reviews, we would like to see these screws either eliminated or have alternative storage holes in the chassis so that they won't be lost.

In use, the D6000 operates a very refined way. The disc drawer opens and closes smoothly and quietly, without hesitation. Tracks are accessed quickly, typically under three seconds, and mechanical noise is quite low.

Performance measurements

Measuring the performance of CD players can be a jading experience since so many decks have so little to distinquish them — they are all good — but few are outstanding. In this case though, the D6000 stands out. Its frequency response was unusually flat from 20Hz to 18kHz and was then only 0.25dB down at 20kHz.

Linearity tests also gave some of the best results measured to date. There was only -1dB error at a level of -80dB, and only -1.5dB at 90dB. Many decks have linearity errors much greater than this.

Results for total harmonic distortion and separation between channels were more or less standard though, and in line with Shure's conservative specifications of 0.01% and -80dB at 1kHz respectively.

Signal-to-noise ratio was very good with a result of -103dB and intermodulation distortion was very good with a result of 0.0036%.

Tracking tests generally gave good results too. On the Philips No 4a defect disc, the D6000 got the all clear apart from some intermittent faint mistracking on the 900 µm interruption. It easily played a badly warped disc which has fazed other decks, with the laser pickup actually periodically bumping the underside of the disc in some cases. And on our badly scratched disc it managed to load and play all tracks except two.

The D6000 is also very good as far as susceptibility to shock and vibration is concerned and it seems quite insensitive to bumping and jarring. So on the whole, the D6000 turns in a very good tracking performance.

The performance summary is therefore good: excellent sound quality, good measured results, good tracking and refined operation, especially with the remote control. What more could you want? Recommended retail price is \$1899.00.

For further information regarding the Shure Ultra D6000 contact the Australian distributors, Audio Engineers Pty Ltd, 342 Kent St, Sydney, 2000. Phone (02) 29-6731. (L.D.S.)

ITION HOUND HOUSE TO THE WAY OF THE PARTY OF

256TC

It's as easy to use as the 'phone'. The new Microbee 256 TC features powerful built-in software ready for you to select at a single keystroke. It's a very personal new Microbee, the result of years of intensive, creative product development. The 256 TC incorporates all the major advances made since the first Microbee was introduced. And it's for you, for your personal business, for your familys education and for keeping you in touch with the information age.

The new Microbee 256 TC is available in three

The new Microbee 256 TC is available in three packages. Education, Home, Office and Executive. Take a trip to your nearest Microbee store or 'phone in for a catalogue. You will soon discover a totally new class of computer - the TELECOMPUTER from Microbee.

AND IT'S FOR YOU!

Features include 256K high speed RAM. Single or dual 800K 3.5" disk drives, built-in software and an Australian designed full featured ergonomic keyboard.



THE AUSTRALIAN COMPUTER

Sydney (02) 487 2711 Melbourne (03) 817 1371 Brisbane (07) 3943688 Perth (09) 396 8289 Newcastle (049) 61 1090 Adelaide (08) 212 3299 Gosford (043) 242711

SEE THE NEW 256TC AT THE MICROBEE STAND AT THE PC87 SHOWS



A simple temperature-controlled crystal oven

Does your frequency meter drift as it warms up and as the ambient temperature changes? Unless it has an oven-controlled crystal oscillator it will drift quite a lot. Here is a simple, easy to make, crystal oven which controls the crystal temperature within close limits.

by IAN POGSON, VK2AZN

These days, many people have a seven or eight digit frequency meter in their workshop. Such an instrument is vital for frequency measurements but the accuracy of many DFMs is often questionable in spite of the fact that they have so many digits.

There are two problems to be overcome in ensuring that the best possible accuracy is obtained from a frequency meter. The first is calibration and the second is overcoming drift in the crystal oscillator timebase due to temperature changes. The problem of calibration can't really be addressed until drift is fixed.

What is drift?

All frequency meters have a crystal oscillator timebase which provides the reference frequency against which the frequency to be measured is compared. In the best of worlds, the crystal oscillator reference would be "absolute", dead on frequency to within ±1Hz and unchanging in value regardless of time, temperature or any parameter.

Unfortunately, that is not the case. The typical 10MHz crystal found in most digital frequency meters is nominally only within about ±1kHz of its designated frequency, although when calibrated it is usually within about ±10Hz at a particular temperature. Here is where drift comes into play.

All oscillators drift, which is to say

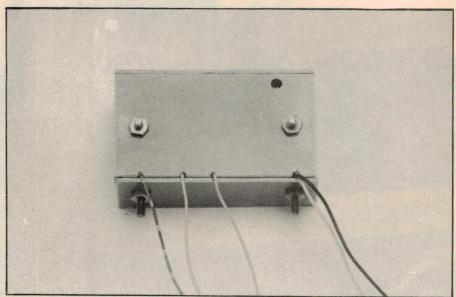
that their operating frequency changes with temperature. In LC or RC oscillators, the drift is due to the temperature coefficients of capacitance, inductance and resistance of the frequency determining components. In crystal oscillators, temperature has less effect but it is still quite marked and needs to be compensated if the best accuracy is to be obtained.

Fig.1 shows the drift of typical ATcut crystals. In order to make the graphs as general as possible, the frequency axis is labelled in parts per million so if we are considering a 10MHz crystal, we could multiply all the values on the vertical axis by 10 to obtain the exact frequency variation in Hertz.

Fig.1 shows three curves. These are just three examples of a large family of curves for 10MHz AT-cut crystals. The variation in curve shapes is a result of very small differences in the angle at which the particular crystals are cut from the mother quartz. As can be seen, these small differences lead to quite large variations in the crystal's temperature performance.

Notice that all the curves have a common crossover point, corresponding to a temperature of 27°C. Curves A and B each have turnover points while curve C has no turnover points at all. (A turnover point is where the curve gradient goes from positive to negative or vice versa)

The upper turnover point of curve A is at about 53°C, while the upper turnover point for curve B is at about 88°C.



The crystal oven is housed in an insulated box made from PCB laminate.

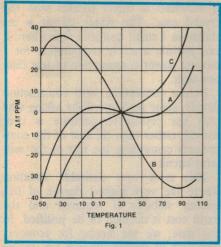


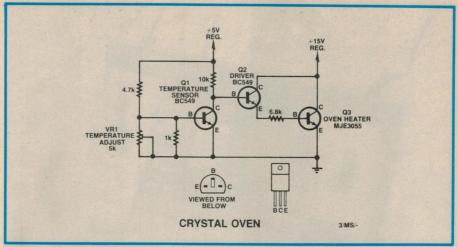
Fig.1: typical drift vs. temperature curves for 10MHz AT-cut crystals.

Note that these three curves are typical but there are whole families of curves for crystal performance, depending on the way in which they are cut. Pick a curve, any curve.

The task of determining the best curve to use depends on the circuit. For a simple circuit designed for ambient temperature conditions, a crystal with curve A would be close to ideal. Note that it has very little variation in frequency between about -10 and +70°C.

On the other hand, where a crystal is to be used in a temperature-controlled oven, curve B might be selected. This has a turnover which is safely above any expected ambient temperature maximum. Fairly obviously though, there is little point in selecting a higher temperature of operation than is necessary.

Curve C, on the other hand, being fairly linear with temperature, might be selected for crystals to be used in tem-



The circuit uses just three NPN transistors. Q1, in direct contact with the crystal, serves as the temperature sensor and controls the current through Darlington pair Q2 and Q3.

perature-compensated circuits, which is a more economical approach to the temperature problem. Unfortunately, satisfactory compensation is not easy to achieve.

The foregoing gives a general indication as to the best choice to be made for the most desirable operation of a crystal with regard to temperature. This means that a crystal would be ordered with the required specifications.

Reality recovered

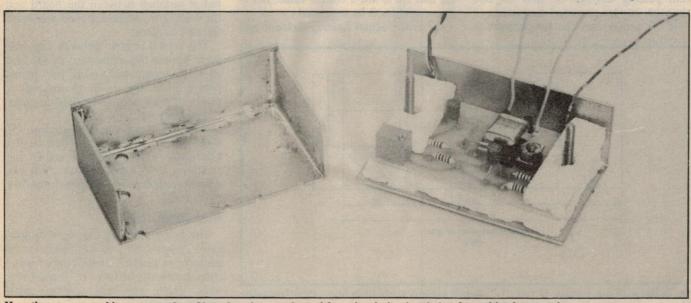
So much for the most desirable situation. Let's now get our feet firmly back on the ground. There are many off-the-shelf crystals available today at quite reasonable prices and which may be used with satisfactory results. Most commonly, these crystals are intended for non-critical applications and have a temperature characteristic similar to that of curve C.

These can be operated in the oven to be described and the combination is very satisfactory. Astute readers will already be asking the question, "What about the non-existent turnover point where it is desirable to operate an ovened crystal?" The simple answer is that we ignore this ideal and do the next best thing.

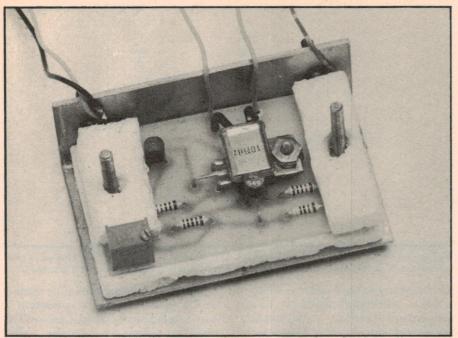
Good performance can be obtained by operating the crystal at a temperature between about 45°C and 50°C. If operation is considered in the tropics, then the temperature of the oven will have to be increased to, say, 60°C or more.

It must be admitted that a crystal similar to curve C does not give the best possible frequency stability but it is a whole lot better than lesser measures.

So much for the reasons why it is so desirable to control the temperature of



How the oven assembly goes together. Note that the top piece of foam insulation is missing from this photograph.



Close-up view of the PCB assembly. The crystal is held firmly against the temperature sensing and heating transistors (Q1 and Q3) by a top layer of foam insulation (see text).

a crystal. Let's now have a look and see how this may be achieved.

The circuit

The essence of the circuit is very simple. It uses a small signal NPN silicon transistor as the sensing element followed by a Darlington transistor pair as the heating element.

This is how it works: The temperature sensing transistor (Q1) is in direct contact with the case of the crystal. Q1 is biased on, as set by the $5k\Omega$ trimpot connected between its base and emitter. The voltage at the collector of Q1 therefore determines the amount of current passing through Q2 and Q3 and thus the amount of power dissipated.

If Q1 senses that the temperature is

reducing, its collector current will be reduced accordingly and the base voltage perature back up to the required value.

temperature is rising, it will tend to reduce the conduction of Q2 and Q3, to bring the temperature back down to

In practice, the $5k\Omega$ trimpot is used to set the operating temperture of the oven. The 5V supply to Q1 should be well regulated, as from a 3-terminal regulator (eg, 7805). The 15V supply to Q2 and Q3 is not a critical value, nor is it essential for it be regulated.

Q3 is the actual heating element and

of Q2 will rise. This will increase the conduction of Q2 and Q3, raising the power dissipation and bringing the tem-Alternatively, if Q1 senses that the

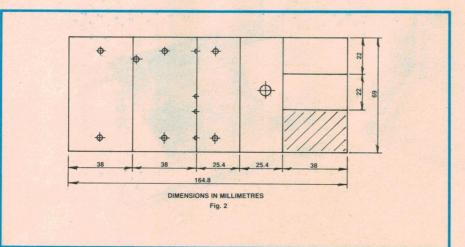


Fig.2: the oven box consists of two "L" shaped sections made from blank PCB laminate. This drawing shows the dimensions of the various sections.

is mounted in direct contact with the crystal case. The whole circuit is installed in a small insulated case where it can provide a stable temperature for a modest power consumption of less than

Before proceeding with construction details, some readers will be asking why only the crystal temperature is controlled, rather than the rest of the components comprising the rest of the osillator circuit.

This is a very desirable situation where the very highest degree of frequency stability is required and the extra cost is deemed to be justified. In our case, we are aiming for economy and ease of implementation (ie, taking the easy way out).

Construction

All of the components for the circuit and the crystal are mounted on a printed circuit board coded 87ov4 and measuring 61 x 36mm. As noted above, only the crystal is controlled, so none of the other oscillator circuit components are mounted on the board. A pair of flying leads from the printed circuit board connects the crystal to the relevant oscillator circuit.

As such, the circuit could be used for timebase temperature control in frequency meters, synthesised tuners and computer equipment.

Mount the four resistors first, then Q2 and the $5k\Omega$ trimpot. Q3 is installed with the back (metal side) uppermost. The three leads are bent to fit the board and the transistor is set so that its hole is in line with the matching hole on the board. A 3mm screw is used to firmly hold the transistor. Note that a spacing nut is installed between the board and the transistor, while a second nut holds the unit in place.

The crystal is now laid with one side flush against the metal face of Q3 and its leads terminated at the two points provided on the PCB. A couple of pieces of sleeving may be used to cover the crystal leads.

With the above items in position, Q1 should now be installed so that its flat side rests firmly against the end of the crystal case. Assembly of the PCB can now be completed by attaching the five flying leads.

Insulated box

The box containing the oven components measures 69 x 38 x 25.4mm and is made from printed circuit copper laminate. It consists of two "L" shaped sections which are held together with screws and nuts.

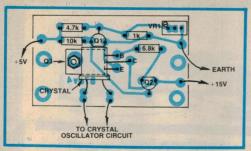


Fig.3: it's vital that Q1, Q3 and the crystal are installed in contact exactly as shown.

The drawing shows how a blank may be guillotined with a minimum of waste. If the board is to be cut with a hacksaw, then due allowance will need to be made for this. To make life just that much easier, Geoff Wood Electronics has agreed to make a set of guillotined panels available.

Several holes need to be drilled in the panels. One is to allow access to the temperature setting trimpot after assembly. A somewhat larger hole is provided on the top panel to allow a thermometer to be inserted to check the crystal temperature. In addition, there are four notches to be filed out along the bottom edge of one panel to provide exits for the flying leads.

You will need a fairly robust soldering iron to solder the panels together. The copper cladding is just like a heat sponge and an iron of about 60W rating will be needed. When soldering the pieces together, care must be taken to make straight and square joints.

Having made the box, we are now ready for the final assembly. From a piece of polystyrene foam (used for packing in cartons), 6mm thick, cut two pieces that will fit neatly inside the two large panels. Two more small end pieces will be required later but these may be dictated by the assembly as it progresses.

Now take two 3 x 32mm screws and push them through the two holes from

the outside on the large panel and screw a nut on each. Pierce two holes in one piece of foam, push it over the screws and up to the panel. Screw two more nuts on firmly so that the foam is flat against the panel. The nuts will then be bedded into the foam.

Now push the PC board over the screws, copper side first and firmly fix with two more nuts. On the bottom panel, drop two 9mm long screws through the two holes provided and run a nut on each. These screws are for subsequent mounting of the oven inside the chassis of your chosen piece of gear.

Using the same technique as before, pierce two holes in the other piece of foam. Also, with a sharp knife, cut a small rectangle out of the appropriate corner of the foam so that it will clear the $5k\Omega$ trimpot.

At this stage it will be obvious where two more small pieces of foam can be cut and fitted at the ends. (The top and bottom edges were left uncovered with foam). Assemble the pieces of foam such that the large piece is in contact with the crystal case.

To complete the assembly of the crystal oven, the other half of the box is slipped into place over the screws and the five leads carefully guided into the four notches along the bottom edge of the panel. This done, the two nuts are added to the screws and lightly tightened to hold the assembly together.

Temperature adjustment

We are now in a position to power up the oven and make the necessary temperature adjustments. You will need a power supply with a very well regulated 5V source and another supply of between 12 and 20V.

The following procedure is suggested for setting up the oven. Set the temperature adjusting trimpot to maximum resistance. Connect the 5V and 15V leads to the power supply, the latter via

a mA meter set to the 500mA range.

Switch on. All being well, the meter will only indicate a very small amount of current, as the MJE3055 transistor will not be conducting. Now rotate the trimpot screw until the current starts to rise on the meter and continue until about 200mA is reached.

It is possible that you may not be able to get the meter reading up to 200mA. If it reaches about 150mA, then this will usually be quite sufficient. When the meter fails to rise further, do not continue to rotate the trimpot screw.

If you wish to increase the current flow through the MJE3055, this may be done by reducing the value of the $6.8k\Omega$ resistor feeding its base. Alternately, if you wish to reduce the maximum current, then the reverse will apply.

Having set the maximum current, wait for a couple of minutes and the current will slowly fall to quite a low level, about 20mA or so. Temperature measurements may now be taken, either with a suitable glass thermometer or a probe. Either can be inserted through the hole provided and the thermometer bulb or probe must be in contact with the side of the crystal case.

Over a period, continue to advance the trimpot until the required temperature is reached. Temperatures between 45 and 50 degrees Celsius should be obtained with a current of the order of 40mA or so. This will vary according to ambient temperature and the value of supply voltage used.

A reasonable time should be allowed for the temperature to stabilise. This should be achieved in an hour or so. When the temperature setting has been finalised, the thermometer should be removed and the hole covered with a small piece of masking tape. The unit is then ready to be connected into the oscillator circuit and put into operation.

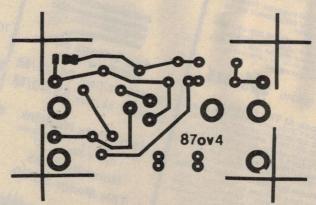


Fig.4: actual size reproduction of the PC artwork.

PARTS LIST

- 1 PCB, code 870v4, 61 x 36mm
- 1 insulated box (see text)
- 2 BC549 NPN transistors
- 1 MJE3055 NPN power transistor
- 1 10kΩ 0.25W resistor
- 1 4.7kΩ 0.25W resistor
- 1 5kΩ trimpot, Bourns 3299 or equivalent
- 1 crystal (for external circuit)

Miscellaneous

Polystyrene foam, copper laminate, screws, nuts, hook-up wire, solder

Yes we've now moved to our Fantastic New Electronics Shop and Warehouse at 174 Roe Street, Perth.

We are over stocked on all these Fine Products so here is your chance to save a bundle - up to 50% on some items



DAY JETSER FOR NEXT

666

RD HOLDERS

ANKCA

Phone Double Adaptor 1/2 Price P 0995 \$4.50

Save 25%

Stick on Rubber feet Trade Packs of 100

H 0952

Save 35% IDC Computer Cable



Was Now W 0616 16 core 2.20 1.50

W 0626 24 core 2.95 1.80 W 0634 34 core 3.90 2.50 W 0650 50 core 7.00 3.95

Save 50% on Sheilded Cable

\$20/100M W 0214 2 core \$45/100M W 0219 4 core



1.111/2 Save a fortune by making your own chassis. Handles up to 16 guage metal 445mm wide. T 2400

Just \$99.95

Up to 50% Off Mini **Toggle Switches**



Holds 12 magazines, each on a spring out wire By or or any of your favourite magazines. Binders for your EA's and ETI's B 9999

Precision Electronic Fet Multimeter For Laboratory Or Workshop We're absolutely delighted with our laboratory FET VOM. The Q 1050 breaks new ground for an advanced, prescision analysis mater of this prescision analysis.

• 10 Meg Ohm input • 12 Amp DC and AC Current Ranges • Centre and AC Current Range and Polarity Zero Pointer Adjust for Holarity ings • Single Range power on LED ings • Transistor Tester inbuilt Reversing Transistor Tester inbuilt Reversing Switch • Polarity indicator • Transistor Tester inbuilt P-P calibrated scale.

breaks new ground for an advanced, prescision analogue meter of this prescision analogue. The O 1050 has quality below \$100. The O 1050 ters the advantage of digital multimeters i.e. insignificant circuit loading, high accuracy etc. without the misleading and erroneous readings that DVM's and erroneous for. Rated Accuracy 50HZ -5MHZ + 3% - 4B -10dB +63dB at all AC are famous for. DC VOLTS 03.1.2.12. Ranges 0.0.1200V 0-30.120.300.1200V 0-30.150.6.6.15.60.150. ranges.
DC CURRENT
DC CURRENT
Ranges 0-0.1 u
Ranges 12A
30. 300mA.12A
potential Drop
potential Accuracy
gated Accuracy 600V at Centre dance-

Ohm at 300mV range Ohm at 300mV range Rated Accuracy 256 Rated Accuracy AC full AC CURRENT Ranges 0-12A DC RESISTANCE AC VOLTS Ranges—RMS 0-3.12. 30.120.00 30.120.00 9-28.0-8.4.33.64. 9-28.0-8.4.33.64. 330.840.3300 \$12.00 Ranges -- 1K Ohm
RX1 0-10K Ohm
RX1 0-10K Oh
RX10 0-100K Oh
RX100 0-100K Oh 330.840.3300 RX10 0-10K Ohm RX100 0-10K Ohm Input Impedance RX10K 0-100 Ohm Approx 1M Ohm BOPF. RX10K 0-1000M Ohm 25M Ohm on 3V Range RX1M 0-1000M Ohm MICRON

Centre Zero Pointer Setting Allows + and - Readings \$79.95 Q 1050

1/2 Price Piezo Tweeter Handles 150 watts plus!!

C 6120

6 or More

Fantastic for HiFi and stage PA's etc. Freq. Resp. 3KHz to 40 KHz

Normally \$19.50

Get a System for Mum and the Kids Full Security System

> Fantastic system for this price. Frankly we were amazed at the performance of this very compact system. very compact system.
>
> Very simple to connect and operate - New Yery simple to connect very compact to the control of the contr

\$ 5310 \$99 \$75

LOOK At The Features
EXIT DELAY 30-35 SeC5. ENTRY DELAY 10
SeC5. DC SOURCE AC adaptor 240/9N DC
SeC5. DC SOURCE AC adaptor 240/9N ACS 40
SeC5. DC SOURCE AC BOOK SEC SOCIATION ACCORDANCE A Accesories included for the One Low Price Accesories included for the One Low Price

4 Sets Ree'd Switches for Window/Dors.

4 Net Ree'd Switches for Window Ports.

5 Peaker Switches 1 External Type Horn.

6 Speaker Switches 1 External Type Horn.

7 Speaker Switches for not Protecting Horn.

8 Speaker Switches for not Protecting Horn.

9 Speaker Switches for not Protecting Horn.

9 Speaker Switches For Switches Switches For Switches

Headlamp Relay 12-16V coil .2 seperate Make sets 30 amp ea.

S 4135 \$10.00



Were

\$15.95

DELIVERY

ш

DAY JETSERVIC

NEXT

FOR

000

666

800

ш

Ш

FF

TOLL

ALTRONICS

PHONE

ERS-

BANKCARD HOLD

Horn Relay

12-16V coil 20 Amp Contacts . S 4130 \$3.75 1/2 Price



10 Amp DPDT

Relay \$ 4074 \$10 (Octal Socket S 4075 \$5)



Solder 200g Reel

10 or more \$6

Big Savings on Rainbow Wire W 0510 10 Core \$1.25/M W 0524 24 Core \$3.00/M

\$9.00ea

Heavy Duty Heatsink Great for 2 x T03 devices 110W x 33H x 72D Normally \$4.95 This Month \$3.50

10 or more

666

800

FREE (

TOLL

PHONE ALTRONICS

HOLDERS

PHONE

BANKCARD HOLDERS

DELIVERY

JETSERVICE

DAY

NEXT

FOR

FAMOUS CALLMASTER PHONE ANSWERING MACHINE



• Dual Cassettes • Record up to 150 incoming messages • Telecom approved

Standard Model A 0510

Remote Control Model A 0515\$259

\$20 Save \$20

MICRO UNIT CLIPS ON TO SUNVISOR \$50 off Top Selling Microeye Radar Detector

Cat. A 1510

NOW ONLY

Incorporates exclusive superheterodyne Horn

Microstrip hybrid circuitry



- · Separate audio alerts for X and K bands
- RSD (Radar Signal Discriminator) switch to eliminate extraneous signals with an LO and LR positions. The amber LED pulses to indicate LO and LR positions.
- Alarm: Red LEDs will light up in sequence as signal strength increases. When all Red LEDs are lit and signal strength continues to increase, all Red LEDs will flash simultaneously

Brilliant Savings on Quality Relays

Cradle Relays — Pinout compatible with ITT and Siemens high sensitivity, high reliability, gold flashed contacts. Operate time 15 MS (Max.), release time 10 MS (Max.). Insulation resistance 100M. OHM at 500V DC. Dielectric strength 1000V AC (1 min.).



S 4067	COIL VOLTAGE 12	CONTACT SET DPDT	CONTACT CURRENT MAX.	Were	Now	10Up
	AND THE RESIDENCE OF THE PARTY	Control of the Contro	2A	\$8.98	\$7.95	\$6.94
S 4068	24	DPDT	2A	\$8.98	\$7.95	\$6.94
S 4070	12	4PDT	1A	\$9.95	\$8.50	\$7.92
S 4071	24	4PDT	1A	\$10.95	\$8.95	\$7.92

Cradle Relay Sockets Includes Retaining Clip

S 4058 for DPDT Relays (S 4067/8) \$2.40 Now \$1.50 S 4059 for 4PDT Relays (S 4070/1) \$2.40 Now \$1.50

240V Mains Power From Your 12V Battery



300 Watt Inverter with **Auto Start**

(See EA Sept.'85)

Just think how handy is would be to have 240 Volt AC Mains Power when camping or for your boat or Caraven.

Auto Start draws power from your battery only when appliance is plugged in and "turned on" i.e. battery can be left permanently connected if desired. Thermal Over Load. Current Regulated. Current Overload.

K 6752 Complete Kit \$229.00 K 6754 Fully built & tested \$289

iss Out! Reserve Your Order Right

Temperature Controlled Soldering Station

(EA Sept.'86)

Controls the temperature of your standard soldering iron. Suitable for Irons rated from 20W—75W — Standard soldering iron plugs straight in no need for modification.

The Altronics Kit comes complete - pre-punched and silk screened. Cat.K 6400

\$35.00



TOROID TRANSFORMERS



30%

M 3075		M 3100		
PRIM SEC 1 SEC 2	240V 40V 2A 40V 2A	PRIM SEC 1 SEC 2	240V 40V 3.7A 40V 3.7A	
M 3	080	M	3105	

M 3080		M 3105		
PRIM	240V	PRIM	240V	
SEC 1	45V 1.8A	SEC 1	45V 3.3A	
SEC 2	45V 1.8A	SEC 2	45V 3.3A	
WERE	\$55	WERE	\$69.95	
NOW	\$38 ea	NOW	\$48 ea	

W/PROOF PA SPEAKERS

PVC 5 WATT 8 OHM

C 2010 ...

C 2015...

\$9.50 NOW

ALUMINIUM 15 WATT 8 OHN

C 2025 . \$29.95



ALUMINIUM 15 AND 30 WATT FITTED WITH TRANSFORMER

15W Taps 660/15W, 1K/10W, 2K/5W 4K/2.5W C 2030 . . . \$72-95

\$65 NOW

30W Taps 330/30W, 660/15W, 1K/10W, 2K/5W 4K/2.5W.

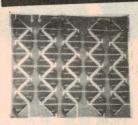
\$95.95 C 2033 \$80 NOW



Yes we've now moved to our Fantastic New Electronics Shop and Warehouse at 174 Roe Street, Perth.

We are over stocked on all these Fine Products so here is your chance to save a bundle — up to 50% on some items





FOR NEXT DAY JETSER

ALTRONICS TOLL FREE 008 999

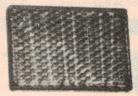
KCARD HOLD

Price Break Through Solar Cell Array 18V @ 7 Watt

Brilliant New Solar Array at an amazing price. Yes, for less than \$90 we now have just the handlest Solar Modules available just the handlest Solar Modules available (Why pay our competitors \$239 for a measly 3 additional watts?? Superb for Powering or Charging 12 - 15 Volt circuits-Now there's now excuse for that flat Car, Boat or Caravan Battery. Solar Cells are fixed to a fibre board, front covered with tough EPS and rivetted into stainless steel frame. Cat No. A 0220

Amazing Price Break Through

\$89.95



Solar Cell Module .4V at 450mA

Great experimenters Solar Module. Connect in parallel or series as you wish Terminal strap enables easy interconnection to other cells. A 0210

Value \$4.50 10 cells or more \$3.98ea





Save a Bundle on these Fantastic Micron Soldering Irons

Temperature Adjustable 250°C to 450°C

Excellent new iron, screwdriver temperature adjustable between 250°C and 450°C enabling very delicate soldering on low settings with surprising heat energy reserve on maximum setting.

Relative temperature is indicated by LED lamp brightness. Much lower cost than a soldering station. T 2445



Professional Temperature Fixed Soldering Iron

370 deg. Fixed Temperature • High efficiency patented heating element.
 Iron clad, chrome plated, long life interchangeable tips.
This iron uses high grade iron clad, chrome plated and pretinned tips. Tip life expectancy is many times that of conventional plated tips.

\$18 Comes supplied with T 2424 tip REPLACEMENT TIPS \$4.50 ea STD CHISEL HEAT UP AND RECOVERY

Professional Megaphone PA



SPECIFICATIONS Power Output Effective Range Power Dimensions Weight Shoulder Strap

20 Watts max Approx. 400M (up to 1KM in ideal conditions) 8 Pcs Cell (not Included) 230 Diam. 360 Length 1.5K (less batteries) Supplied

Controlled Temperature Selectable Soldering Station

The MICRON T 2440 soldering station, offers the ultimate in controlled temperature hand soldering. 320°C, 350°C, 380°C, 410°C (608°F, 662°F, 716°F, 770°F and 824°F) fixed temperatures are selectable by rotating the detained rotary switch freely without changing heater or tip.

Heat Capacity Full 48 Watts

• Temperature Control +or - 3 deg.C •
Zero Voltage Switching • Grounded Tip •
Low Voltage Element 24V • Chrome
Plated Tip. T 2440

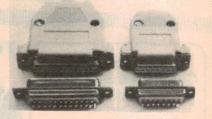
Normally This Month \$119.95



Save Up To 50% On Top Quality D Series Connectors!

Fantastic Value

D Series Computer Connectors. Gold Plated **Professional series**



DB9	WERE NOW
P 3000 Male 9 Pin P 3010 Female 9 Pin P 3020 Male PCB Rt/L P 3030 Fmale PCB Rt/L P 3040 Male PCB mnt. P 3050 Fmale PCB mnt. P 3090 Backshell cover	2.95 1.70 3.25 2.35 3.75 1.85° 4.50 2.20° 2.95 1.95 3.95 2.25
DB15	l. kg
P 3100 Male 15 Pin P 3110 Fmale 15 Pin P 3120 Male PCB Rt/L P 3130 Fmale PCB Rt/L P 3140 Male PCB mnt. P 3150 Fmale PCB P 3190 Backshell cover	3.25 2.25 3.85 2.60 4.35 2.10° 5.50 2.95 3.85 1.90 4.85 2.40° 2.20 1.00
DB25	
P 3200 Male 25 Pin P 3210 Fmale 25 Pin P 3220 Male PCB Rt/L P 3230 Fmale PCB Rt/L P 3240 Male PCB mnt. P 3250 Fmale PCB mnt.	4.95 2.47° 5.50 2.74° 4.95 3.50 6.90 4.95 4.95 4.95 6.25 4.95

P 3290 Backshell cover

These Fine Quality Products

Our 1987 Catalogue for full Specifications on

ZO

ď

PHONE

BANKCARD HOLDERS —

FOR

ERY

面

0

ш

ERVIC

0

W

7

DAY

EXT

Z

FOR

007

See Review Electronics Australia March '86

BRILLIANT AUTO RANGING DIGITAL MULTIMETER

Autoranging with Memory Function for Relative Measurements

SPECIFICATIONS:

DC VOLTAGE

5 (200mV, 2V, 20V 200V, 1000V) DCV Accuracy 0.5% + 1DGT

AC VOLTAGE

4 (2V. 20V.200V.750V) Ranges ACV Accuracy 0.75%+5 DGTS Input Impedance 10M Ohm Min

DC CURRENT Accuracy

20mA-0.75%+1DGT 10A-1.50%+5DGTS



Free Select either a Carry Case or Holster this month with your Q 1075 at no charge

Carry Case

Keep your Labtech DMM looking like new for years!

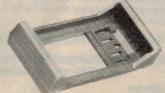
Q 1076

\$9.50

Holster Q 1077 \$9.50

What's this? For want of a better name we've named this thick rubber 'Cliparound" protector a "Holster" Great protector for field use dropping on concrete floors etc.





Now Only UV EPROM ERASER Erase your EPROMS quickly and safely. This unit is the cost effective solution to your problems. It will erase up to 9 x 24 pin devices in complete safety in about 40 minutes for 9 chips (less for less chips).

• Erase up to 9 chips at a time • Chip drawer has conductive foam pad • Mains Powered • High UV intensity at chip surface Cat D 1450 ensures thorough erase • Engineered to prevent UV exposure • Long Life UV tube • Dimensions 217 x 80 x 68mm • Weight 670 grams

AL PRO

14 MILE. Q 1272 111 New 20MHz Model. \$20

Max. Input Frequency 20MHz. Input Impedance 1M ohm. Operating supply Range 4 volt minimum. TTL Logic 1 Hi LED greater than 2.3 volts. Logic 0 Lo LED less than 0.8 volts. CMOS Logic 1 Hi LED greater than 70% Vcc. Logic 0 Lo LED less than 30% Vcc. Minimum Detectable pulse width 30 nano seconds. Maximum signal input 220V AC/DC (for 15 secs.)

Check Appliances And Electrical Wiring Build This 1000V **Megohm Meter**

(1985 Successor to the "Megger")

It uses a transistor inverter to produce a regulated 1000V DC supply which is applied to the insulation under test. Insulation resistances between 2M Ohm and more than 2000 Ohm can be measured. K 2550 (See EA July '85)



Miss Out! Reserve Your Order Right Phone STD Free On 088 999 007

The reproductive purity of these speakers simply amazed us. The secret, of course is the DANISH VIFA.Drivers. VIFA drivers are used in many top selling imported systems such as Bang & Olufsen, Rogers, Mission, Jamo, DCM Timewindow etc.

Build These Fantastic New Playmaster HiFi Loudspeakers

See Electronics Australia Sept '86

full kit K 5090

If your budget won't run to the \$600 to \$800 needed for a fully imported pair of equivalent speakers, these are the ones to go for.



Integrated Amplifier Kit (EA May, June, July '86)

Features:
• 60 watts per channel into 8 ohm loads • Very low noise on all inputs - better than CD performance • Very low distortion • Excellent headroom • Tape monitor loop • Tone controls with centre detent and defeat switch • Mono/stereo switch • Toroidal power transformer • Easy-to-build construction • Very little wiring.

Performance Specification

Power Output — 8 ohms 62W Distortion - Less than .0% at 1kHz. Frequency Response - Phono Inputs - RIAA/IEC equalisation within + - 0.5db from 40Hz to 20kHz Line Level Inputs — -0.5db at 20Hz and -1db at 20kHz Input Sensitivity - Phono 1kHz -4.3mV • Line Level - 270mV. Hum & Noise - Phono - 89db • High Level Inputs - 103db. Tone Control - Bass - + -12db at 50Hz Treble - +-12db at 10kHz. Damping factor - At 1kHz and 30Hz - greater than 80 Stability — Unconditional.



"This New Amplifier offers a standard of performance far ahead of any-thing we have previously published and ahead of most commercial integrated Stereo Amplifiers".

"It is half to one third of the cost of an imported Amplifier with equivalent power output and performance". Says Leo Simpson Managing Editor Electronics Australia Magazine.

Beginner constructors can Build this Amplifier Kit — It looks terrific and will last you a lifetime.

Save \$200 or more on comparable performance commercial units

8

Yes we've now moved to our Fantastic New Electronics Shop and Warehouse at 174 Roe Street, Perth.

We are over stocked on all these Fine Products so here is your chance to save a bundle - up to 50% on some items



TRANSFORMER BARGAIN

MULTITAP 1 AMP M 2155 240/6 to 15V

\$7.95 NOW \$6

NEXT DAY JETSER

OR

ALTRONICS TOLL FREE 008 999 007

PHONE

ANKCARD HOLDERS

a



Ultrasonic Insect and Pest Repeller

estrepeller is effective in controlling mice rats, roaches, fleas, flies crickets, silverfish, waterbugs, moths ants and most other common pests. Laboratory research has shown ultrasonic sound waves attack the snown ultrasonic sound waves attack the auditory and nervous systems of most common pests causing them pain and discomfort. Specifications— Dimensions: 100 x 90 x 80 Power Supply adaptor supplied 240/9V Frequency Range 30KHz to 65KHz variable Output Level 130db.



Headphones for the True Audiophile

Our Somarium Cobalt headphones are a sheer joy. Now you can play Beethoven at full bore without disturbing the rest of the family and, more importantly, enjoy virtually the ultimate in comfort and incredible reproduction - Speakers never did sound so good.



Guaranteed better than any

headphone at twice this price or

Mini Buzzer 5-15V DC



S 5162 \$1.75

Handy little solid state low current buzzer is ideal for use with signaling panels, alarm systems, in the car etc. Polarity conscious

Strobe Signal Lamp

Uses Xenon Strope tube for High energy strobe flash output at a rate approx. 1 per second.Fantastic light energy output for the DC power used. DC input 12V 320mA Dimensions 97 dia.90H



Was \$27.50 Now \$19.00



MU METAL SHIELDED MIC TRANSFORMER

Primary 200 ohm Secondary 50K ohm. Where ultra low "hum" pickup level is designed. Such as mixers, PA amps etc.

M 0701 NOW JUST \$15 ea



TO3 INSULATING KITS

Set of 100 Mica washers and 200

H 1582 \$10.95 NOW \$13

Why Risk Unnecessary Heart Attack?

Heart disease strikes down many people in their early 40's (or even 30's). The tragedy remains that had such victims been alerted remedial medical, physical and dietary action could have been prescribed to avoid illness and in many cases restore full bodily health. X 3055

Blood Pressure and Heart Rate Monitor

- Features:
- Non-Microphone Measurement System LCD Readout

Our 1987 Catalogue fo Refer to

full Specifications on

hese Fine Quality

Products

- Blood Pressure Monitor
- Pulse Rate Monitor

ECONOMY RACK CABINET

Solid steel construction Black anodised front panel 3 unit (132 mm) Conforms to International Standards Ventilated top

H 0400



Why Pay \$150?

X 3055 Only \$89



Infra Red Movement Detector

With interchangeable lens for corridor or wide angle detection

Lens simply 'snaps' to either wide angle (range 40 feet) for normal use or Narrow angle (angle

80 feet plus) for corridor applications.
Snazzy integral mounting bracket allows corner
90 deg. mounting as well as normal surface
mount. (this is a fantastic feature as these work best in corners and are visually unobtrusive) 12V DC Powered

vour money back.

Built-in test lamp Alarm output SPDT 30V 1a

NOW S 5301

LOUDSPEAKER PROTECTION KIT



CHEAP INSURANCE AT ONLY \$89

Protect your valuable loudspeaker system with this easy to build kit. Based on the ETI design (Oct. 82) provides both DC and overpower protection for your valuable Hi-Fi speakers. Self-powered unit disconnects the speakers within 1/10th of a second of a fault occuring yet in no way affects the sound quality

Install it in minutes — No AC or DC connections required — Simply connects into the left and right channel speaker lines. **K 5050**

Superb Printer/Display Calculator for the Office



HI FI EXTENSION SPEAKERS

200mm (8") 10 watts max.power input. Public Address, Background Music. Ideal Hi Fi extension speaker. Includes transformer holes at 51mm. Over 60,000 Sold in Australia! Mounting holes 140mm x 140mm

\$12.95 \$9.ea C 2000

CEILING GRILL

For 8" Speaker C 0800

FOR DESPATCH P& P CHARGES AND ADDRESS DETAILS PLEASE REFER TO OUR AD. ON PAGE

ERS.

HOLD

ANKCARD

m

Microphone Super Sale BIG SAVINGS THIS MONTH

ELIVER

۵

Ш

 $\overline{\mathbf{o}}$

Ш

S

JE

DAY

EX

Z

Œ

FO

007

800

Ш

Ш

FB

ALTRONICS

ш

PHON

BANKCARD HOLDERS

For Professional 2 way Radio's on Aircraft, Boats, Vehicles and also for Industrial PA Systems.



Stereo Microphone

Superb for Stereo recording of vocal or music Includes stand. Fantastic performanc Frequency Response 50-18KHz 1000 Ohr -68db 3M Lead. DC 1 AA ce



Electret Condenser Microphones One for the Kids

Low Cost Wireless Mic

Absolutely the "Bees Knees" for the kids to sing along into the Hi Fi home FM receiver ghetto blaster or portable FM Radio.

Great Fun for all the family Transmitting Frequency: 88-108MHz FM, tough ABS, powered by one AA penlight battery.

A Great Present for that Budding "Star"

Two Function Cardioid Microphone

Wireless or Electret operation (simply swap over the antenna and output lead). Frequency 88-108MHz 3M Lead supplied DC 2 x AA Penlight.



Lavalier (Lapel) Superb little microphone. Clips to tie, shirt etc. Ideal for lecturers religious speakers, stage work etc Uses 1.5V alkaline manganese LR44 battery (supplied) Includes tie clip.

\$32.50

ALC Wireless Microphone

Superb roving entertainment microphone. Our incredible ALC Microphone is one of the most exciting products. We all know how handy it is to operate a microphone without trailing cable— of course, wireless mics suffer from overmodulation distortion with too higher input sound level making them totally unsuitable for high grade vocal entertainment





105 STIRLING STREET, PERTH OR INSTANT SERVICE **PHONE ORDER TOLL FREE**

008 999 007

PERTH METRO AND AFTER HOURS ORDERING SERVICE

(09) 328 1599 ALL MAIL ORDERS

.O.Box 8350 Stirling St.Exchange Perth. Western Australia. 6000

PACKING AND DELIVERY CHARGES

We process your order the day received and despatch via. Australia Post. Allow approx. 7 days from day you post order to when you receive goods. Weight limited 1Kg.

6023499

process your order the day received and despatch via. overnight jetservice Courier for delivery next day. Country areas please allow additional 24-48 hours.

Weight limti 3Kgs.

\$6.00 HEAVY MAIL SERVICE FOR

deliveries exceeding 3Kgs and less than 10Kgs - allow 7 days for delivery \$10.00 HEAVY HEAVY SERVICE - All orders of 10Kgs. or more must travel Express Road - Please allow 7 days

for delivery — As with virtually every other Australian supplier, we send goods at consignees risk Should you require comprehensive insurance cover against loss or damage please add 1% order value (Minimum charge \$1). When phone ordering please request "Insurance"

TOLL FREE PHONE ORDER

Bankcard Holders can phone order toll free up to 6pm Eastern Standard Time. Remember with our Overnight Jetservice we deliver next day

Altronics Resellers

Chances are there is an Altronics Reseller right near you - check this list or phone us for details of the nearest dealer.

Blue Ribbon Dealers are highlighted with a . These dealers, generally carry a comprehensive range of Altronic products and

kits or will order any required item for you.

Don't forget our Express Mail and Phone Order Service—for the cost of a local call, Bankcard, Visa or Mastercard holders can phone order for same day despatch.

Please Note: Resellers have to pay the cost of freight and insurance and therefore the prices charged by individual dealers may vary slightly from this Catalogue - in many cases, however Dealer prices will still represent a significant cost saving from prices charged by Altronics Competitors.

NIGW

WA
COUNTRY
ALBANY
BP
Electronics ■ 412681
ESPERANCE
Esperance
Communications 713344
GERALDTON
K.B.Electronics
& Marine 212176
KALGOORLIE
Todays
Electronics ■212777
MANDURAH
Lance Rock
Retravision 351246
Watronics 751734
WYALKATCHEM
D & J Pease 811132
1011102
NT
DADIMINI

MANDURAH	
Lance Rock	
Retravision	351246
NEWMAN	
Watronics	
WYALKATCH	EM
D & J Pease	811132
-	-
NT	38 Z 3
DARWIN	the sales
Ventronics	813491
ALICE SPRIN	Control of the Contro
Ascom	49
Electronics	E01710
Farmer	521/13
Electronics	E22067
Liectronics	522907
ACT	
ACT	
CITY	
Bennett Commer	rcial

Electronics 805359

Scientronics.....548334

NSW	
CITY	
David Reid	
Electronics ■	
Jaycar	2671614
SUBURBAN	
CARINGHAH	
Hicom	
Unitronics	
CARLINGFOR	
	8724444
CONCORD	7450077
GORE HILL	7453077
Jaycar	4394799
HURSTVILLE	7007100
	5707000
LEWISHAM	
PrePak	
Electronics	5699770
COUNTRY	
ALBURY	
Webb's	
Electronics ■	
COFFS HARBO	DUR
Coffs Habour	
GOSFORD	.525684
Tomorrows	
Electronics	247246
KURRI KURRI	. 24/240
Kurri Electronics	372141

NEWCASTLE D.G.E.Systems

George Brown & Company 696399

Elect.Supplies ... 616055

15	Electronics■	.218412
4	EAST MAITLA	
	East Maitland	ND
	Electronics	007007
		.33/32/
	ORANGE	
8	Fyfe	
	Electronics	
4	RAYMOND TE	RRACE
	Alback	
7	Electronics	873419
	TENTERFIELD	.010110
9	Nathan Ross	362204
•	TOUKLEY	. 302204
0	TES Electronics .	004444
•	WINDSOR	. 964 144
	The Control of the Co	
0	M & E Electronics	
U	Communications	
	WOLLONGON	G
	Newtek	
	Electronics	.271620
6	Madjenk	
•	Electronics	743061
	Vimcom	
	Electronics	284400
4		. 20-1400

NOWRA

	MaGraths
,	Electronics 6631122
	SUBURBAN
	ASPENDALE
	Giltronics 5809839
3	CHELTENHAM
•	Talking
,	Electronics 5502386
	CROYDEN
	STREET, STREET
	Truscott
	Electronics ■ 7233860
	PRESTON
	Preston
	Electronics 4840191
)	SPRINGVALE
	Active
	Electronics ■ 5471046
2	COUNTRY
	BENDIGO
	Control of the Contro
	KCJohnson ■411411
	MORWELL
	Morwell
1	Electronics 346133
	SALE
	Gippstech ■
	Communications 447402
	SHEPPARTON
	GV Electronics ■ .218866
	SWAN HILL
	Cornish Radio
	Services321427

VICTORIA

Electronics ...

Ellistronics■.... 6023499

All Electronic

Components

Active

Deisound P/L	2290100
Jaycar	3930777
SUBURBAN	
FORTITUDE V	ALLEY
F.H.S.	~
Electronics	9222700
	0323700
Economic	
Electronics	523762
PADDINGTON	
Jacques	
Electronics	2000504
SLACKS CREE	:K
David Hall	
Electronics	2088808
TOOWONG	
Techniparts	3710879
COUNTRY	01.00.0
CAIRNS	
Thompson Instru	ment
Services	.512404
Services BUNDABERG	
Bob Elkins	
Electronics	.721785
GLADSTONE	
Supertronics	.724321
MACKAY	
	. 578855
NAMBOUR	
Nambour	
Electronics	.411604
PALM BEACH	
The Electronic	
	.341248
ROCKHAMPTO	.341240
	714
Electron	
World	. 278988
Access Electronic	S
(East St.)	21058
Purely Electronics	
(Shopping Fair)	
	. 200 100
Xanthos	
Electronics	.278952
TOOWOOMBA	
Hunts	
Electronics ■	.329677
TOWNSVILLE	
	722015
OO.OX =	. , 22013

QUEENSLAND

Delsound P/L .. 2296155

SA CITY Electronic Comp & Equip. 2125999 Force Electronic ■ ... 2122672 2123111 SUBURBAN BRIGHTON 2963531 CHRISTIES BEACH Electronics ■ . . 3823366 ENFIELD Force .. 3496340 PROSPECT COUNTRY 2694744 MT.GAMBIER South East Electronics ...250034 PT.LINCOLN West Coast Elect Supplies ... 825802 WHYALLA Eyre 454764 TASMANIA HOBART George Harvey ■ LAUNCESTON ■ .342233 Electronics 315688 George Harvey ■ .316533 **Nichols** Radio TV......316171 LEGANA Frank Beech Electronics 301379

MORE ALTRONICS DEALERS WANTED

If you have a Retail Shop, you could increase your income significantly by becoming an Altronics Dealer. Phone Steve Wroblewski 09 3817233 for Details

CESA Hifi Grand Prix Awards

The best hifi products for 1986

The third year of the Australian hifi awards resulted in awards in all but two categories: tuners and turntables. The winning brands were all Japanese: JVC, Marantz, Pioneer, Technics and Yamaha which received two awards.

by LEO SIMPSON

The third year of the CESA Grand Prix awards, Australia's own hifi awards, reflected the tough nature of the hifi market in recent times. There were less products entered in most categories and some categories did not have many entries at all.

Disappointingly perhaps, the closing date for entries prevented a number of manufacturers from presenting products which might have altered the outcome in some categories, or at least, stiffened the competition. Still, that means an interesting round in the awards for next year.

On being confronted by all the entries for this year's awards, the judges' first reactions were that there were just not enough entries. Closer examination revealed that there were indeed some good products but that in one or two categories the number and quality of entries might not be enough to give a good result.

The overriding concern of the judges of these awards was that they maintain a high standard. If there was any suggestion that winners in some categories were not really up to par, the whole award concept would be jeopardised. With this in mind, the judges considered all the entries very closely and deliberated at some length before coming to their conclusions.

As a point of interest, the prices of some hifi products have increased mark-

edly since the entries for this year's awards closed, at the end August 1986. In one or two cases the price increases have been as high as 30%.

This has been due to the considerable appreciation of the Japanese yen against the Australian dollar. Most of this appreciation occurred in late 1985 and early 1986 but the effect on prices was delayed as long as possible by the hifi importers and distributors. Prices quoted throughout this article are those effective in February 1987.

Amplifiers

In many ways, amplifiers still present the greatest interest to informed high fidelity enthusiasts. It is in the category of amplifiers that the technology is perhaps best understood and the greatest refinement has taken place. In spite of that, the introduction of compact disc technology has caused a re-examination of amplifier design with a view to improving the overall dynamic range, both by increasing the available power output and by improving the overal signal-to-noise ratio.

At the same time, there has been a trend in recent years, especially in amplifiers produced in Europe, to reduce the number of controls and facilities available to the user. The reasoning behind this is that the extra controls and circuitry can have a deleterious effect on the music reproduction and therefore

should be left out.

Indeed, some amplifiers from Britain have had virtually no controls at all apart from a volume control and input selector. And never mind the fact that this simplification means a much cheaper unit to produce; some of these amplifiers have been very expensive.

Considering that this has been a noticeable trend, there were not many amplifiers of this design philosophy entered in the awards. There were eleven entries in total, with all except one being integrated models. In alphabetical order, the entries were:

Luxman LV105 "Brid" integrated stereo amplifier, 80 watts per channel ... \$1995.00.

Technics SUV60 integrated stereo amplifier, 90 watts per channel ... \$1069.00.

Yamaha C-2x preamplifier and B-2x power amplifier, 170 watts per channel ... \$5598.00.

All the above power figures represent the rated power into 8-ohm loads for the amplifiers concerned; ie, they are the continuous power output ratings for the frequency range from 20Hz to 20kHz without exceeding the rated distortion.

However the bald figures do not necessarily represent a fair comparison.



JVC's feature-laden and powerful model R-X500B was the clear winner in the receiver category.

Some amplifiers, such as the Yamaha, have much lower rated distortion than others and some amplifiers have much greater headroom so that they can deliver considerably more power on short musical transients.

In a similar vein, some of the amplifiers can drive very low impedance loads and hence can deliver much higher output currents than otherwise might be expected.

For example, the NAD 3130 looks, on the face of simple power figures, to be a fairly modestly powered model. It has a rated power of only 30 watts per channel but it has a generous headroom figure of +3dB. This means that it is able to deliver 60 watts per channel into 8-ohm loads on a short term basis. Furthermore, into a load impedance of only 2 ohms, it is able to deliver 85 watts per channel under the same conditions.

Another amplifier which has generous headroom and output current capability is the Rotel RA840BX. While rated at 40 watts per channel it will deliver about 95 watts into 8 ohms on a short term basis and has an instantaneous output current capability of 29 amps. (Incidentally, an article on the requirements for output current capacity was published in the November 1986 issue of EA.)

The largest and most expensive amplifier among the entries is the Yamaha C-2x/B-2x combination. The power amplifier is rated at 170 watts per channel but once again has a good headroom figure of 1.88dB for 8-ohm loads and 2.7dB for 4-ohm loads. This means that it can deliver over 260 watts per channel into 8 ohms and over 440 watts per channel into 4-ohm loads. And with an instantaneous current capacity of 25 amps it can deliver no less than 625 watts per channel into a 2-ohm load on a short term basis.



Pioneer's PD-M6 multiplay CD player has a cassette loading system which lets it handle up to six compact discs.

Power is not the end of the story though and the Yamaha combination has excellent figures for harmonic distortion, signal-to-noise ratio and separation between channels, as you might expect.

Another interesting innovation in the

newer amplifiers is the inclusion of a "CD direct" facility whereby the signal from the CD player inputs is coupled directly through to the power amplifier via the volume control. Thus, the tone control stages and balance control are completely bypassed, which should (but



Yamaha's winning K-540 cassette deck has Dolby HX-Pro, B, and C noise reduction and is good value at \$599.00.

does not always) lead to an improvement in signal-to-noise ratio, channel separation and harmonic distortion.

In theory, with today's power amplifiers it should be possible to obtain a signal-to-noise ratio of better than 110dB with respect to a 2-volt input signal for such a direct connection.

Those amplifiers which included this feature were the Technics SUV60, Marantz PM94 and Luxman LV-102.

For the judges though, the newest and most interesting amplifier of the group was the Marantz PM94. In some ways, this amplifier represents a return to the Marantz design philosophy of old. It is large, heavy and no expense has been spared to make it a very fine amplifier.

Just how large and heavy it is is indicated by the physical measurements. Its dimensions are 416 x 146 x 410mm (W x H x D) and mass is a solid 25kg.

The PM94 has very flexible controls and features which can be used or ignored. Some of its features include: transformers for the moving coil cartridge inputs, to gain better signal-tonoise ratio; very large toroidal power transformer for low hum radiation; hifi VCR inputs; large ceramic-damped electrolytic capacitors (27,000 µF) in the power supply; and a copper-plated chassis.

The last two features certainly border on the esoteric. The ceramic damping of

the electrolytic capacitors is claimed to eliminate "vibration at high current and high sound levels" while the copper plated chassis is said to provide "full non-magnetic screening to minimise induced currents in the chassis. Result: lower distortion".

We can accept the first concept but have difficulty accepting the second, especially since a number of Japanese manufacturers (including Sony) are promoting the desirability of a non-magnetic chassis but giving different garbled explanations of why it is necessary.

Apart from any reservations that at least one judge may have had about justifications for a copper plated chassis, the judges were unanimous as far as the amplifier category was concerned. The Marantz PM94 was the winner by a fair margin.

Receivers

Surprisingly, there were only three entries in this category. They were:

In many ways this was an uneven contest; two modestly powered receivers against JVC's hi-tech battle-cruiser

which has lots of power and abounds with more features than most people will ever use.

Naturally, the former receivers are much cheaper than the JVC but while they are undeniably good products with the NAD featuring +3dB of headroom (giving it the same performance as the NAD 3130 described above) they offer fairly routine performance standards and nothing in the way of extra user convenience. They are simply outgunned by the JVC R-X500B.

Many of the features of JVC's R-X500B stereo receiver will probably be dismissed as gimmicks by the audio purists who prefer spartan simplicity.

Features that might be rejected on this basis might include the JVC's flashy seven-band graphic equaliser and analyser which is computer-controlled and the fully electronic controls — there are no knobs on this receiver. But consider that it has moving coil and moving magnet cartridge inputs, tape dubbing for two cassette decks, high power at very low distortion and infrared remote control for all the major functions, including volume. It was the winner.

Tuners

There were four entries in this category, all of which were fully synthesized tuners. They were the JVC T-X900B at \$949.00, the Marantz ST64 at \$699.00,



The Yamaha DSP-1 digital signal processor reproduces the acoustic environment of large and small concert venues.

the NAD 4130 at \$399.00, and the Sharp ST207 which is part of a rack system at \$1799.00. Not an exciting line-up at all although there are some good tuners there.

The judges decided to make no award in this category since there were no really outstanding models submitted and none included AM stereo reception. Let us hope there is a better line-up next time.

Turntables

There were only two entries in this category, with one not being eligible since it is only available in a complete rack system, the Sharp R-207X. That left the Dual CS 5000 semi-automatic turntable which comes in two versions: the classy walnut veneer job with Ortofon OMB-20E cartridge at \$1099.00 and the sombre black version without cartridge at \$950.00.

A semi-automatic turntable, by the way, is one in which the tonearm must be manually started but which has automatic lift-off of the tonearm at end of play.

Now make no mistake, the Dual CS5000 is a very fine turntable. It has a microprocessor-controlled DC motor with belt drive at speeds of 33, 45 and 78 rpm and has excellent figures for rumble, signal-to-noise ratio and wow and flutter. It also has an optical sensor for end-of-play detection which means that there are no extra side forces on the stylus.

The problem with the Dual was that it was the only entry and the judges therefore felt that they could not justify an award. This is a great pity since there are other good turntables in the market although admittedly it does seem as though the Japanese manufac-

turers are abandoning the turntable scene.

Cassette decks

This was a most interesting category with seven entries:

Akai GX-R70	\$849.00
JVC DD-VR77	\$1099.00
Marantz SD-74GL	
NAD 6155	. \$799.00
Sharp RT-207XBK	\$1749.00
Technics RS-T80R	\$1179.00
Yamaha K-540	\$599.00

By contrast with the above categories, competition in the area of cassette decks was, and is, intense. There are decks with Dolby B, C and HX PRO plus dbx noise reduction. Some models were double cassette decks with comprehensive dubbing facilities and quick auto-reverse.

The Akai GX-R70, for example, is a single front-loading deck with quick auto-reverse, Dolby B, C and dbx noise reduction and computer control of the recording level. The quick-reverse facility, by the way, uses a head assembly which can be swapped around very rapidly so that there is almost no interruption during recording of lengthy broadcasts or lectures.

Similarly, the JVC DD-VR77 is another quick reverse deck with Dolby B and C with music scan, editor and optional infrared remote control. By contrast, the Technics RS-T80R is a dual deck with all three noise reduction systems, quick reverse, versatile editing, parallel and series recording. In the latter mode, using two C-90 tapes, you can make a continuous three-hour recording. With all these features, the Technics deck was a strong contender for an award.



Marantz's impressive PM-94 amplifier puts out 140 watts per channel.

Marantz's SD-74 is a single deck with dbx, Dolby B and C noise reduction systems, quick auto-reverse and peakhold fluorescent meters which makes it also an attractive package. But as far as the judges were concerned, the Yamaha K-540 was the winner. It was regarded as having the best combination of performance and features for a reasonable price.

Compact disc players

This was another category which was strongly contested with eight entries, as listed below:

Akai A-70	\$699.00
dbx DX3	. \$1995.00
Marantz CD-65	\$599.00
Pioneer PD-M6	\$999.00
Sharp DX120HBK	\$999.00
Technics SLP-500	\$999.00
Toshiba XR-P9RC	\$449.00
Yamaha CD 2000	. \$1499.00

As far as user convenience is concerned, six of these players come with infrared remote control as a standard feature, with the exceptions being the dbx and Marantz models. Only three have over-sampling, being the dbx, Marantz, and Yamaha models. In other respects, all but two of the entries offer fairly standard features and performance. The exceptions are the dbx DX3 and the Pioneer PD-M6 multiplay CD player.

The dbx DX3 is the first to incorporate a compression facility. This is not surprising really since the dbx company has been a specialist in audio compression and expansion techniques since its inception. The compression feature is incorporated so that CDs can easily be transferred to cassette for listening in a car or in a portable player.

The reduction of dynamic range by using compression also makes it easier to use CDs for background listening where the pianissimo (soft) passages would otherwise be lost and the fortissimo passages would be overbearing.

As well, the dbx incorporates two other unusual features, digital audio impact recovery (DAIR) and an ambience control. The latter control can be used to add or subtract high and mid-frequency difference information from both channels to increase or decrease the perceived spaciousness of the sound.

The DAIR control is a more radical feature which is supposed to compensate for the inevitable peak compression of CDs which have been reprocessed from analog master tapes. It can also add another 10dB to existing 96dB dy-



The Technics SB-RX50 is the first new coaxial system for many years.

namic range of CDs to augment the impact of percussion instruments.

All the judges concerned agreed that the dbx player was an innovative product but there was a general leaning towards Pioneer's multiplay CD player with its cunningly designed magazine which holds six compact discs. It also has the ability to play up to 32 selections from the six loaded discs, in any order or alternatively, play all disc track selections in random order. The Pioneer is the only domestic CD player which can play six discs (the only other non-professional player is the Sony Disc-Jockey for cars).

The combination of multiplay and a reasonable price was a winning one for Pioneer. It will be interesting to see how many other manufacturers introduce multiplay machines in the future.

Loudspeakers

There were five entries in the loudspeaker category and they were surprisingly diverse, embracing the price range from \$450 a pair to \$3999.00 a pair.

Kef C40, 2-way sealed box \$	\$949.00
Mordaunt Short MS-10, 2-way vented box	\$450.00
	1799.00
Technics SB-RX50, 2-way vented box	\$749.00

It manages to do so, in spite of having a very small woofer, by combining a quite reasonable efficiency together with an elegant system of overdrive protection using positive temperature coefficient thermistors. (These loudspeakers were reviewed in our September 1985 issue and the use of PTC thermistors was discussed in an article in our July 1986 issue.)

The Kef C40s are a very popular module in the mid-priced bracket and combine relatively high efficiency (91dB/W/m) with excellent power handling and extended bass response from a 30 litre cabinet. It is unusual in that it has two low frequency drivers, with one being used to augment the very low bass

Yamaha's NS-1000x was the dearest entry and is essentially a refined and upgraded version of the NS-1000M, which was introduced about a decade ago and has always been very highly regarded.

However, the system of most interest was the Technics SB-RX50 which is a technological tour-de-force. It is the first new coaxial speaker system to be introduced for over twenty years. Both the tweeter and woofer have rigid, flat diaphragms and the tweeter has a high-energy samarium-cobalt magnet. The tweeter diaphragm is made of mica while the woofer's is reinforced with carbon fibres.

Add to that the additional magnet on the rear of the woofer housing to cancel stray magnetic fields (which can affect picture purity when close to video monitors), the rear mounted reflex port, a nominal impedance of 6 ohms (to extract 50% more power from the driving amplifier) and excellent power handling capacity, and you have a system which deserves a second look.

Very well received by reviewers both here and overseas, the Technics SB-RX50 was a clear winner, for innovation, sound quality and value for money.

Technological development

Interestingly, this category had the most entries, with some companies have a second attempt at an award, by entering a product in both this and another category.

category.	
JVC HR-D725 hifi VCR	\$1849.00
Kef 107 3-way	
loudspeaker system	\$7500.00
Luxman LV102 stereo amplifier	
	\$1299.00
Luxman LV105 stereo amplifier	
	\$1995.00
NEC AV-300E Home	
Theatre Sound System	\$2344.00
Shure HTS-5000 Home	

Theatre Sound System	\$2600.00
Sharp WQ-CD15H CD/radio/cassette player	\$999.00
Technics SB-RX50 two-way loudspeaker system	\$749.00
Yamaha DSP-1 digital sound processor	. \$1349.00

There are some expensive products in that line-up and most are pretty interesting in their own way. Take, for example, Kef's 107 loudspeaker system which is a considerable refinement of their multi-award winning 104.2 model. Or the two Home Theatre Sound sytems from NEC and Shure. Both these decode the Dolby Surround information on stereo videotapes to provide spectacular surround sound from four channels.

But there is one product which is really new and which stands out as the winner for technological development: the Yamaha DSP-1 Digital Sound Processor. This uses up-to-the-minute digital circuitry to greatly modify the perceived acoustics of the listening room. It can change both reverberation and decay times to simulate a large auditorium, concert hall, cathedral, or other venue — you name it, you can be there. We'll see a lot more of this product and others like it in years to come.

Post mortem

Well, what conclusions can be drawn from these latest awards. For a start, there really were not enough entries. That is hard to understand since the industry is supposedly going through a really tough time and hifi distributors would probably wish for as much exposure as they could get.

Second, while it might be expected that the smaller companies who have less personnel would be less able to enter the awards, it is less understandable as far as the larger players are concerned. What happened to the distributors of brands such as Sony, Nakamichi, B&W, Kenwood, Onkyo, Proton, Perreaux and virtually all the brands sourced from Europe and the UK? There are some very fine products being missed out here and some would certainly have been in the running for an award. Let's hope they wake up next year.

The judges for this year's awards were: Greg Borrowman, editor of Australian Hifi; David Frith, audio writer for the Sydney Morning Herald; Louis Challis, acoustics consultant and audio reviewer for *Electronics Today* and Leo Simpson, Managing Editor, *Electronics Australia*.



MELBOURNE (03) 487 3333 SYDNEY (02) 858 5966 ADELAIDE (08) 232 0001 BRISBANE (07) 277 4311 PERTH (09) 367 6330 HOBART (002) 342 233 LAUNCESTON (003) 316 533

New Products...

Product reviews, releases & services



Cellular telephones from Mitsubishi

Mitsubishi Electric has released its Telecom-endorsed cellular telephone range. As a mobile system for vehicles and boats the cellular system offers greatly improved performance without the limited availability and shortcomings of the existing mobile system.

The Mitsubishi system also provides a choice of a vehicle installation or portable unit and either unit can be up-

graded when required.

Call diversion, a network function, makes the new mobile telephone even more effective and Mitsubishi's "hands free" remote microphone ensures safe driving.

For further information, contact Mitsubishi Electric Australia Pty Ltd, 73 Epping Rd, North Ryde, NSW 2113. Phone (02) 888 5777.

Printer buffer

The printer Qr is an intelligent data buffering and queuing device designed to organise your computers, printers and plotters into one co-ordinated system.

Connected between your computers and printers/plotters, the Printer Qr allows all users to be permanently on line to the shared printing resources. The printer Qr will accept data simultaneously from all inputs at high speed, check for software commands, then spool to the appropriate printers at a rate they can accept.

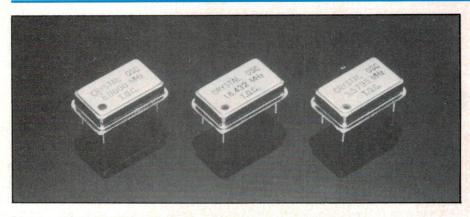
Four or five computers can share two or three printers. For larger installations the special cascade feature can be used to connect two or more Printer Qrs together, to increase the number of ports and amount of buffer memory available.

The buffer offers up to 512K with dynamic allocation to each user. Sophisticated character compression techniques are used on all repeated characters, greatly increasing the effective buffer size (eg, a 750K dot matrix plot file is compressed to 120K in the buffer).

The Printer Qr can be operated transparently, or a comprehensive set of commands are available giving the user full control over each print operation. Temporary or permanent printer selection can be made, copies specified single sheet feed control and more. Also included are commands for more specialised applications.

The Printer Qr is manufactured in Australia by Diamond Systems.

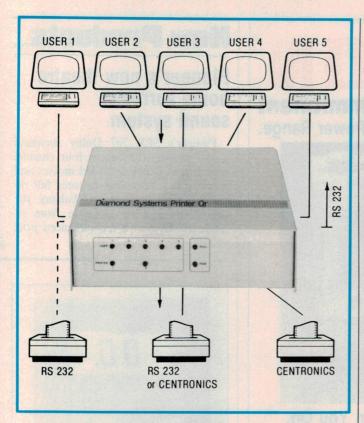
For further information contact Diamond Systems, PO Box 105, Hurstbridge, Vic 3099. Phone (03) 714 8269.

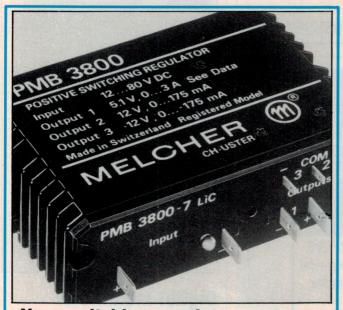


Crystal clock oscillators

Alfatron has announced the availability of the TQC crystal oscillator series. The series comprises a C-MOS crystal oscillator with specified frequency from 3.2MHz to 26.999MHz and two TTL crystal oscillators with specified frequencies from 1MHz to 3.199MHz and 27MHz to 70MHz respectively.

For further information, contact Alfatron Pty Ltd, 1761 Ferntree Gully Rd, Ferntree Gully, Vic. 3156. Phone (03) 758 9000.





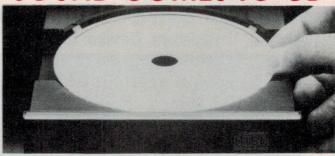
New switching regulators from Melcher

Melcher Switzerland has introduced a range of switching regulators with several outputs. The PMB series offer an exceptionally large input voltage range: 12-38V DC and 12-80V DC with output power from 20-25 watts.

These units are small in size and are a very compact design.

Melcher products are available from: Jessec-Switches Plus Components, 569 Hampton Street, Hampton, Vic. 3188. Telephone: (03) 598 2333.

AN ASTONISHING NEW SOUND COMES TO C



Clarity, transparency, imaging, openness...

Shure Ultra D6000 explodes the myth that all CD players sound pretty much the same. It ushers in a new generation of sound purity that transcends the whole notion of audio 'reproduction" and brings the sense of the actual reality of a musical performance. It is the best and most natural music source available at any price.



Compensates for imperfect discs...

Its advanced laser system uses three beams instead of one: one reads the disc while the other two give micro-precise guidance to the reader beamovercomes vibrations and disc imperfections.

PURELY PERFECT

The only 5-year laser warranty

The LONGLIFE™ laser tracking system is engineered for a minimum of 8000 hours of service. (Replacing lasers on "bargain" CD units is prohibitively expensive.)



ULTRA COMPACT DISC PLAYER



AUDIO ENGINEERS PTY. LTD 342 Kent Steet, Sydney, NSW 2000 Ph: (02) 29-6731

AUDIO ENGINEERS (QLD)

West End, Qld 4101 Ph: (07) 44-8947

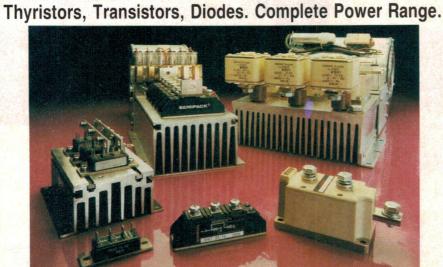
MARKETEC PTY. LTD.

Cnr. Jane & Buchanan Sts, 51 Scarborough Beach Rd, North Perth, WA 6000 Ph: (09) 242-1119

AUDIO ENGINEERS (VIC) Ph: (03) 850-4329

SEMIKRON

innovation + service = Total Commitment



Stud, Transi or Discreetly. We Can Turn You On. Try Us.

SEMICRON: P.O. Box 182, Springvale, 3171 (03) 561 3044

If you know the difference between a diode and a transistor, send us a signal.

If your interest lies in electronics, the RAAF would like to make you an expert in monitoring vital ground and airborne electronics communications equipment.

To apply, you must be between 17 and 34 with Year 10 education.

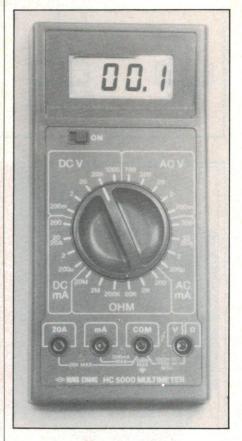
	THE RESIDENCE OF THE PROPERTY OF THE PARTY O	1111
Address		
	Postcode	
Telephone	Date of Birth	
Highest Educ. level attained or bein	ng studied	-

Authorised by Director-General of Recruiting, Dept. of Defence.

New Products...

Pioneer's new theatre home surround sound system

Pioneer's SPX 707 Dolby surround sound processor produces four channel sound from Dolby recorded movies and music videos. The unit features full remote control to vary and balance the sound and will be available from selected retailers at a recommenced price of \$595.



Digital multimeter

Neotronics has announced the release of the HC 5000 digital multimeter which has voltage ranges from 200mV AC and DC to 1kV DC and 750V AC. The AC and DC current ranges are from 200 microamps to 10 amps and up to 20 amps via a separate jack, while the resistance ranges are from 200 ohms to 20 megohms. The meter comes complete with test leads.

For further information, contact Neotronics Pty Ltd, 37 Ryedale Rd, West Ryde, NSW 2114. Phone (02) 807 2642.



Miniature microphones from Crown

A new series of miniature microphones from Crown, released by Magna-Techtronics in Australia, provides the on-set and studio user with the sound of larger, expensive condenser microphones in a remarkably small and durable housing.

Less than half the diameter of a twocent coin, the Crown GLM mini microphones are particularly suitable for filming and studio recording where placement of larger mics would be physically or visually undesirable.

Available in both omnidirectional condenser and hypercardiod condenser versions, the GLM microphones are entirely self-contained, with no extra equaliser or interface box needed for operation.

The series can be powered from an unusually wide voltage range of 12 to 48V and offers a smooth and wide fre-

quency response which has been optimised with a specially-designed beveled acoustic port.

The series also has significantly less mechancial noise than other small microphones. Crown claims to have successfully minimised low-frequency pickup and clothing noise interference and have selected cabling with the lowest mechanical noise conduction.

For further information, contact Magna-Techtronics, 9 George Place, Artarmon, NSW 2064. (02) 427 0666.

Stereo phase monitor

B&B systems have released the new AM-3B Phase Monitor for all stereo audio applications. The unit provides real time visual and audible monitoring of stereo audio phase, program VU levels, and peak threshold levels, including L+R or AUX, in one system.

The AM-3B features dual three-channel inputs (selectable A/B), a separate level control for an isolated power amplifier and loudspeaker, and a headphone output which is selectable for

stereo, L+R, or AUX and follows the A/B input selection.

Other features include a CRT X-Y phase monitor, with calibrated graticule for phase, and three ANSI calibrated VU meters with peak overload LED indicators for each channel. The AM-3B is self contained in two EIA rack units.

For further information contact Radio Manufacturing Engineers Pty Ltd, Unit A, 30-32 Skarratt Street, Auburn 2144. Telephone: (02) 648 2531.

Software debugger for IBM PC/XT

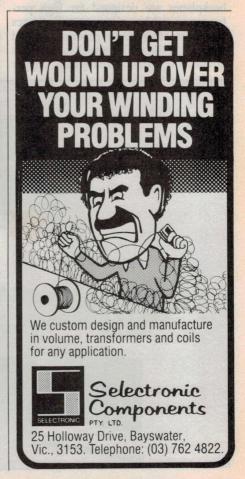
Macro Dynamics has announced the release of the Atron PC Probe. The PC Probe is a real-time hardware-assisted software debugging aid that plugs into a PC/XT slot. It has 128K bytes of hidden write-protected memory on board for storage of symbol table and debugger, leaving the system memory free for the program being debugged.

PC Probe has hardware-assisted break points that can trap on reading, writing, executing, input and output on single or a range of addresses, and can include particular data values. The history of the program is saved on-board, in real time. Once a hardware trap has oc-

curred the program history can be displayed in detail, including symbols and the user's source code. Source Level Debug is supported for C, Pascal, Fortran and Macro Assembler.

The PC Probe family includes software performance and timing analysis tools. These can measure the duration time of procedures and measure the relative amount of program execution time spent in user-defined address ranges.

For further information, contact Macro Dynamics Pty Ltd, 80 Lewis Road, Wantirna South, Vic. 3152. Telephone: (03) 220 7260.



New Products...

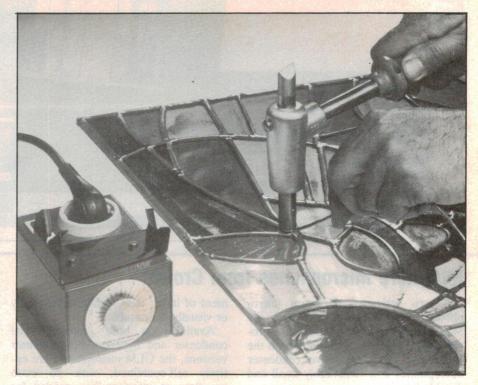
Zeva hatchet soldering irons

Zeva's range of hatchet type soldering irons is now available through Alfatron. Like other Zeva hand tools, these irons feature a heating element protected inside a cast aluminium sheath. This protects the element from shock and corrosion.

The aluminium casing is also an excellent heat reservoir which prevents rapid cooling when an iron is applied to a large surface.

Hatchet type irons are extremely well balanced in the hand and reduce operator fatigue. It also makes them very useful for hard to get at jobs.

For further information contact Alfatron Pty Ltd, 1761 Ferntree Gully Road, Ferntree Gully, Vic. 3156. Phone (03) 758 9000.



Deluxe card cages

Electronic Solutions has just released the V-800 series of card cages. The backplanes are designed for high performance and have low crosstalk figures which are achieved by generous ground planes and the use of guard earth tracks around the clocks. Heavy-duty copper

clad power planes ensure low losses and high current carrying capability.

A special centre adaptor converts any double or triple size slot to a single height slot. This allows mixing of cards of different heights. The adaptor module installs or relocates in seconds.

The cages may be mounted in any

axis and have special aircraft-type fasteners to ensure positive grip. A corrosion resistant aluminium finish is employed to add to their durability.

For further information, contact Alfatron Pty Ltd, 1761 Ferntree Gully Rd, Ferntree Gully, Vic. 3156. Phone (03) 758 9000.



Fluke breaks the old mold.



The Fluke 37. A bold new shape emerges with more features for the money than any other bench DMM.

Dollar for dollar, the new Fluke 37 is unbeatable. In addition to its breakthrough design — with built-in handle and storage compartment — it has all the high-performance features of the world's best, most reliable 3½ digit DMMs.

Autoranging, to eliminate guesswork. Audible Continuity, so you don't have to look at the display. An exclusive analog and digital display, for the best view of the signal being measured. Superior EMI shielding. And user-friendly features like auto self-test, auto battery test and autopolarity. All this, plus a two-year warranty.

And, how many other bench meters give you these features? Min-Max recording, for monitoring signals. 38 components dedicated exclusively to input protection. Relative mode, to help you calculate changes in readings. And Fluke's patented Touch Hold, to give you an extra set of hands when you're taking critical measurements.

None. Not at any price.

FROM THE WORLD LEADER IN DIGITAL MULTIMETERS.





FI LIKE 37

0.1% basic dc accuracy
Analog/Digital Display
Volts, Ohms, Amps, Diode Test
30 kHz AC bandwidth
Fused 10A Range
Integral handle, storage compartment
2-year warranty

ELMEASCO

Instruments Pty. Ltd.

Talk to your local Elmeasco distributor about Fluke -

- A.C.T. John Pope Electrical (062) 80 6576 J Blackwood & Sons George Brown (062) 80 4355
- N.S.W. Ames Agency 699 4524 George Brown 519 5855 Newcastle 69 6399 Bryan Catt Industries 526 2222 D.G.E. Systems (049) 69 1625 Petro-Ject 550 1388
- David Reid 267 1385 W. F. Dixon (049) 61 5628 Macelec (042) 29 1455 Ebson 707 2111 Selectroparts 708 3244 Geoff Wood 427 1676
- N. TERRITORY J Blackwood & Son (089) 84 4255, 52 1788 Thew & McCann (089) 84 4999
- QUEENSLAND Auslec Electric (075) 91 4199 St Lucia Electronics 52 7466 Cliff Electronics 341 4655 L. E. Boughen 369 1277 Fred Hoe & Sons 277 4311 The Electronic Shop (075) 32 3632 Thompson Instruments (Cairns) (070) 51 2404
- S. AUSTRALIA Protronics 212 3111 Trio Electrix 212 6235 Industrial Pyrometers 352 3688 J Blackwood & Son 46 0391 Petro-Ject 363 1353
- TASMANIA George Harvey (003) 31 6533 (002) 34 2233
- VICTORIA Radio Parts 329 7888 George Brown Electronics Group 878 8111 G B Telespares 328 4301 A.W.M. Electrical Wholesalers Petro-Ject 419 9377
- J Blackwood & Sons 542 4321 R.K.B. Agency 29 7336 Sirs Sales (052) 78 1251 Mektronics Co 690 4593 Truscott Electronics 723 3094
- W. AUSTRALIA Atkins Carlyle 481 1233 Dobbie Instruments 276 8888 Protronics 362 1044

SUBSCRIBE NOW!

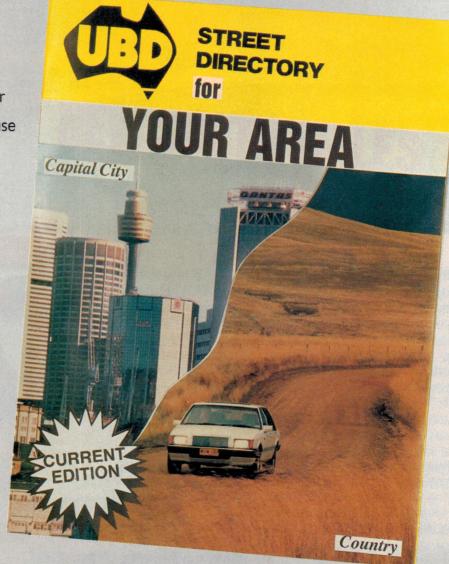
RECTORY



Need another Street Directory — to replace your old out-of-date edition? to have as an extra in the house or second car? Here is your chance! Simply subscribe or renew your subscription now and receive FREE the current edition of the most up-todate, widely used Street Directory in Australia.

UBD Street Directories used by Ambulance, Police, Fire Brigade, MWS & DB, Dept. of Main Roads, Taxi Co-ops, Couriers, Government Agencies and Fleet Owners.

CAPITAL CITY OR COUNTRY DIRECTORY



See Subscription Coupon If coupon/card missing, please phone (02) 693-6666 and ask for the Subscription Department.

NT: will receive Touring Guide and Local Map. SA: will receive an Adelaide Street Directory and State Touring Guide.
TAS: will receive State Directory
NSW, VIC, QLD, WA: indicate Capital City or State Directory

Note: Free gift is forwarded under separate cover. Please allow 3-4 weeks.

Offer closes last mail June 30, 1987.

New Products...

Mobile converters for **Midland Syn-Tech** portables

Midland LMR has introduced Mobile Converters for the Midland Syn-Tech portable radios that convert them into efficient mobile installations. When inserted in the Mobile Converter, a Syn-Tech portable instantly becomes a highcapability synthesised "mobile" with automatic connection to power supply, mi-crophone, antenna, 5W audio amplifier, loudspeaker and (in Models 70-H30/70-H40) to a high-performance RF amplifier.

A fast-release lever permits the user to quickly extract the unit and exit the vehicle with a fully functioning portable. A key lock secures the unit if the operator wants to leave the portable in vehicle. The converters accept Syn-Tech portables with any standard rechargeable battery pack.



Model 70-H40 for high-band Syn-Tech portables has 25W RF output and 5W audio; Model 70-H30 for UHF Syn-Tech portables has 25W RF and 5W audio; and Model 70-CHO5, without RF amplifier, accepts either VHF or UHF portables and provides 5W audio.

The converters are interchangeable with Syn-Tech underdash mobiles in most vechicle installations depending on model and depth available.

For more information, contact Codan Pty Ltd, PO Box 227, Chatswood, NSW 2067. Phone: (02) 419 2397.

New VCRs from National Panasonic

National Panasonic has recently released a new videocassette recorder, the NV-G20A, featuring refined slow motion and HQ circuitry for much improved picture quality.

Included in the list of features is onetouch recording (OTR) and a onemonth, 8-program timer which allows the user to preset timer recordings as much as a month in advance.

The new rewind auto shut off allows the NVG20A to automatically eject the cassette and turn itself off when rewinding is completed. Combined with the infrared remote control, this further adds to the convenience of this VCR.

The NVG20A also includes a newly designed mechanism and direct-drive cylinder motor with oil film suspension system. This suspension system floats the DD cylinder on a thin film of oil during rotation, virtually eliminating friction and vibration, to give a much smoother operation than possible with

conventional bearings.

Recommended retail price is \$1029. For further information, contact your nearest video retailer.



MICRO-EDUCATIONAL P/L 8/235 Darby St NEWCASTLE 2300

Australia's largest computer mail-order company

OUR LATEST LIBRARY DISK FOR YOUR APPLE, IBM, or MACINTOSH (Add \$10 for Mac 3.5" disks)

These disks contain the best in public domain software. Send 6 x 36c stamps for post.

Ask for your FREE CATALOG

Dear George,
Please rush me a free library disk for my IBM/ APPLE/ MACINTOSH (Add \$10 for Mac disks) Enclosed Please find 6 x 36c stamps.

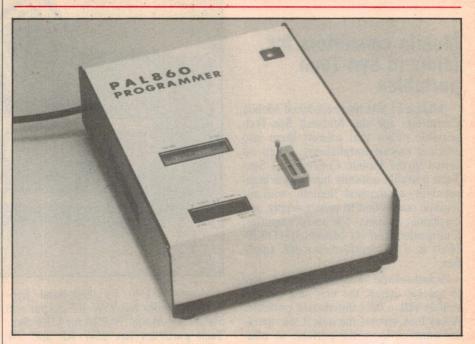
NAME:-

ADDRESS:

P/CODE:



New Products...



PAL860 low cost PAL programmer

The PAL860 is a companion product to the popular PROM8500. It is a compact, economical and effective programming tool for the development of 20 and 24-pin programmable array logic devices.

As a stand-alone unit it is able to load fuse data into its buffer, verify fuse patterns, write and secure PALs and do function testing after programming. An RS-232 interface allows connection to a host computer for remote control. The PAL860 is JEDEC format compatible

and can be used together with commonly used Boolean data entry packages.

An integral two-line alphanumeric display enables easy control of the unit. Only three keys are required for standalone operation. Non-volatile memory retains data for manufacturer, device type, fuse maps and test vectors.

For further information contact Alfatron Pty Ltd, 1761 Ferntree Gully Rd, Ferntree Gully, Victoria 3156. Phone (03) 758 9000.

Design Engineer Electronics

Location: Eastern Suburbs - Melbourne
Our clients are involved in advanced communications design and development.

They are seeking to employ an Engineer with a degree/diploma in communications engineering who has significant experience in original design and development work at microwave frequencies up to 10 GHZ, with practical experience in stripline technology and the use of CAD. It is essential that applicants prefer and are self motivated towards producing timely results without supervision.

The expansion programme within the organisation is both exciting and real. An excellent rapid career development opportunity like this does not arise very often. Interested? Then please forward your details as follows:



Noel J. Ray and Associates Pty. Ltd.
Management Consultants

18 Bank Place, Melbourne, Vic. 3000. Weekdays (03) 67-3702. Tel. Sat. and Sun. (053) 68-9511,

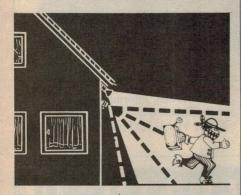
Moving message sign display

Novatech Controls has released a new range of stationary and moving message displays with 50mm high LED characters for industrial and commercial applications.

The displays are inexpensive and can be programmed from a computer or from a keyboard supplied. Their normal colour is red but green and yellow multicolour are also available.

16 alphanumeric characters are displayed at any one time and the memory can store up to 3768 characters. When set to moving mode, several speeds are available.

For further information contact Novatech Controls Pty Ltd, 8 Knox St, Belmore, NSW 2192. Phone (02) 758 1122.



Automatic lighting control

There are many passive infrared devices in use for intrusion alarm systems, but few that can be used for directly switching lighting.

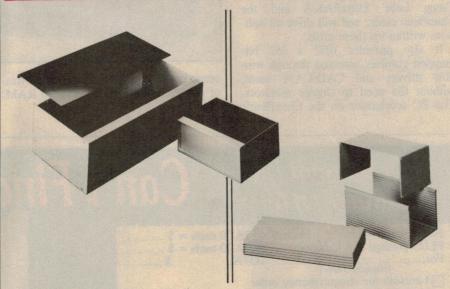
Utilux has recently introduced their Scanelite which is suitable for both indoor and outdoor use and capable of switching up to 2kW (resistive) loads. The detection unit is small, about 75mm square and has a range up to approximately 15 metres.

It functions by the detecting heat and movement. If a person moves into the detection zone, the unit will operate and switch on the selected lights. After a preselected time (adjustable between 12 seconds and 12 minutes) and providing no further movement has been detected, the Scanelite switches off the lights automatically. An inbuilt photocell is provided and this can be adjusted to allow daylight walk tests or provide operation only at night.

For further information contact the Scanelec Division of Utilux Pty Ltd, 14 Commercial Road, Kingsgrove, NSW 2208. Phone (02) 50 0155.







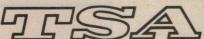
For that total professional look, put your components into one of BETACOM's smart, strong Instrument Case Enclosures. Made of tough powder coated aluminium these enclosures will look good for years

look good for years.
Easy to assemble in a variety of sizes, supplied with all the hardware and shrink wrapped for protection. IC4 is an extruded aluminium, 2 piece enclosure, available in 6 sizes. The unique "square wave" internal slotted extrusion allows for slide in standard 100mm Eurocard printed circuit boards. The cover is screwed at each end and can be custom modified in various lengths and colours. IC6, is a 14 piece box with finished aluminium front and back panels, and is screwed from the sides and rear.

The supplied internal chassis can be mounted in 3 different positions on its support brackets, enabling components to be mounted independently. IC6 comes in 20 sizes, 1U-4U, ½ width and full width and a range of depths. Full width will fit into a standard 19" rack cabinet using optional rack mount brackets. Handles are available for 3U and 4U sizes.

Both these enclosures come in bright distinctive colours for that totally professional look for all your projects. These are just 2 of BETACOM's extensive range of enclosures. Call us today for more information.

BETACOM



TEMPLE-SMITH AUSTRALIA PTY. LTD. 2-12 Harp Street, Campsie. PO Box 196, NSW 2194 Telephone (02) 78 3436 Fax (02) 787 2529

VICTORIA: Temple-Smith Australia Pty. Ltd. 12 Rosella St., Frankston. Victoria. Telephone (03) 781 1013. Fax: (03) 783 9151 SOUTH AUSTRALIA: Graphic Electronic Industries Pty. Ltd. 168 Payneham Rd. Telephone (06) 363 0277 WESTERN AUSTRALIA: J.G. Thomas & Associates 5 Durnham Rd., Bayswater 6053. Telephone (09) 272 7122 QUEENSLAND: Conwell Trading Company Pty. Ltd. 52 Doggett St., Fortitude Valley 4006. Telephone (07) 52 7850









New Products...

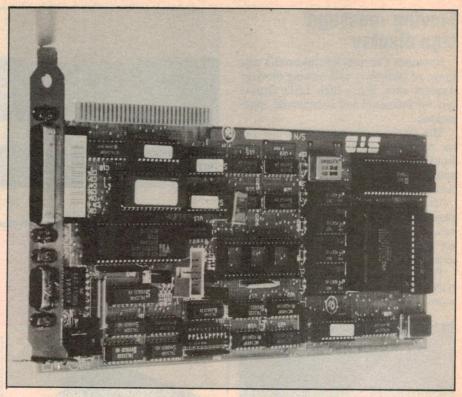
New PC video boards

Roland Corporation has released what the company describes as "the ultimate" in IBM compatible graphics boards.

The product, the STB Chauffeur HT (Hi-tech), is designed to overcome the main PC hardware and software "mismatches" and finally enable spreadsheet users to display a full 132 columns on a standard IBM monochrome or colour monitor.

The STB Chauffeur incorporates all the features of IBM's Mono/Printer Display Adapters, the Hercules Graphics Card, the STB Super-Res 400, and Tseng Labs' UltraPAK-S and the Chauffeur cards, and will drive all software written for these cards.

It also provides 1052 x 352 bitmapped graphics accessed through window drivers and CAD/CAM users, without the need to change monitors. The PC accelerator on the Chauffeur's



accompanying disc provides 64K-bytes of printer buffering and up to 10 RAM disks.

For further information contact Roland Corporation, 50 garden St, South Yarra, Vic. 3141. Phone (03) 241 1254.

Can't Find It? File It! Special Binder Offer Please send me binders @ \$8.00 each = \$ PLUS postage and handling @ \$2.00 each = \$ For.....TOTAL I enclose my cheque/money order (with this form in an envelope) for Charge by Bankcard Mastercard American Express Visa with (10% Discount for orders of 6 or more) Card No. **Expiry Date** Signature (unsigned orders cannot be accepted) Mail Post Free in Australia to: Freepost No. 4 The Federal Publishing Company P.O. Box 227 Waterloo, N.S.W. 2017 Initial Sumame These attractive, ready to use, sky blue vinyl binders have been specially designed to hold and protect 12 of your valuable magazine collection in the easy clip-on fastener wires. Date of Order: Telephone: (

Amplifiers

TD300

\$800.00

Slave Amp (150 watts per channel into 16 ohms) with stereo to mono switching. \$2500.00

ZPE SERIES II

500 Mosfet Output Stages 250W into 8 ohms for bands that want power!

Disco Mixers

CITRONIC SM 350 \$1100.00 6 Channel Input (2 Mi

Citronic SM450 \$1500.00 ARISTA MM4 \$450.00 6 Channel Input with Equalization

ARISTA MM5 \$260.00 Value for money!

Jumbo Strobe

White Flash Jumbo Strobe with Speed Control. Every performer should have one.



Lamps

Carton Quantity Only No Warranty on Breakages

DX60-ES, 240v, 60w

Discolux (soft glass) E.S., assorted Box of 25 - \$90.00

G40BC, 240v, 40w

BC Lamps in Blue, Yellow, Orange Red, Green, Box of 100 - \$85.00

G25BC, 240v, 25w

Box of 100 - \$75.00

FLOURESCENT TUBES \$3.50 \$6.50 White Colours \$48.00 Ultra Violet 4 ft.

Turntable

TECHNICS SL1200 Top of the range Direct drive with \$850.00

Free Stanton Cartridge TECHNICS DIRECT DRIVE \$290.00

TECHNICS BELT DRIVE \$190.

TECHNICS C/DECK \$190 PIONEER B/DRIVE \$190



Scanner

\$190.00 \$101 Search Lighting effect

Scanner Bar

\$590.00 Light bar housing four GE 4515 lamps scanning with individual motors

All housing complete with front cover and with pro-vision for colour gel.

Rope Lights

Border Lights

FOR BANDS BL104 - S195 DISCOS, CLUBS FREE Gel Filter Frame Mount Bkts ADVERTISING. DISPLAYS

Available in tubes: red, green, blue, yellow or clear with multi-coloured lamps. All spiral and tred proof RL 105 (5 metre length) \$135 RL 110 (10 metre length) \$185 RLE 106 (6 metre rope ext) \$19

ROPE CONTROLLERS RLC 104 100 w/ch \$120

RLC 404 400 w/ch \$195 RLC 4000 1000 w/ch \$350

Mirror Balls

005, \$58 MB 012, 12" S88 MB 014, 14" S120 MB 018, 18"

> \$160 MB 020, 20"S195 MB 024.24" \$220
>
> MB 012C Mirror
> Cylinder (12" length)
> 6" Dia. — \$52

MIRROR BALL MOTORS: A.C. 240V Heavy Duty — \$100 A.C. 240v — \$39 Heavy Duty Battery Motor S35
Battery Motor \$15.00

Controllers

AUDIO/CHASER (DW 4LC 4000) \$360 Pre-set Programmed Controller 4 Channels each 1000W

LIGHT COMPUTER (DW 7LC 4200) Programmable 7 channel with E-prom (16 programmes). Ideal for Advertising signs and Disco lighting.

444111

A zero 88 4 ch controller

Gaffer Tape (Black) per roll \$8 **Packaging Tape** per roll \$6 Please Note: All DW products have 12 mth wty.

New Product Coming — Scented Smoke Fluid

Helicopter

A GE 4515 lamp in housing can be swivelled and directed up or down spinning 360° in the one Plane

RPS102 2 ARM SPINNER \$300.00 **RPS104 4 ARM SPINNER** \$498.00 RPS106 6 ARM SPINNER \$550.00

UFO 324 UFO LIGHT (24X GE '4515 S2200.00

Disco World pty. Ital

SHOWROOMS:

300 Main Street, Lilydale. 673 High Street, Preston.

Melbourne, Victoria

P.O. Box 509, Lilydale, Melbourne Victoria 3140

Telephone: (03) 735 0588 HEAD OFFICE

icto phones GN 33 cm Flexible Chrome Arm,

goose-neck S6.90 186C Chrome Base Mount \$3.90

Disco

Structural

Trussing

for clubs

\$839

etc

518C Arista Mike \$80 **UD312 Primo Mike** S120

102 Mike Stand, Adjustable \$93.80 SMOKE HL43U Flexible MACHINE, Arm Mike Holder – (Great for Special Effects!) \$395.00 \$3.50 Fluid — 1 litre \$15.00

Pinspot

PS 112S (Par 36 can) \$59.00 30w) Designed specifically for Mirror Ball Spotting. Used widely to achieve a bullet beam effect. BONUS OFFER:

> Buy 12 pay for only 10 **PAR 46** S75 PAR 56 S130 PINCHASER \$700 Exclusively for Pinspots

Halogen Beacons

WL 104 - \$185.00 Warning lights are available in different colours.

Artlite

20th Century plastic in flat sheets (2 mm or 100 mm) or round tubing (8 mm) that glows under ultra violet lighting. Available in 5 different colours.

Ideal for disco installations, bands and signwriters.
From \$5.65 per metre!!

Cosmos

Light

Mirror Ball housing 24 x GE 4515 lamps with provision for colour gel spinning in two planes, (vertical and horizontal)

Band

Truss

Rigging

Winchup Tree, etc.

\$2800.00

DOUBLE COSMOS: Two Mirror Balls in each housing, 12 x GE 4515 lamps. DCL 212 \$3700.00

HALF BALL ROTARY LIGHT: 14" Dia. housing 6 x GE4515 lamps. Provision for Colour ge HLG 06 S780



eccepted of the second Rolling Light

Metal framed housing rotating 360° in two planes, all with provision for colour gel RL 108, 8 x GE 4515 lamps \$1800 RL 124, 24 x GE 4515 lamps (Horizontal) \$2600.00 RL 224 24 x GE 4515 lamps (Vertical) \$2600.00

Aussie Product

DYNAMITE SMOKE MACHINE

Has remote control lead to operate off-stage. Ideal for Bands, Discos, Night Clubs and TV Productions. Australian made \$1,800.00 Our own developed product.

PLEASE NOTE: Some installation items do not include power

ALL PRICES ARE INCLUSIVE OF SALES TAX.
ASK ABOUT OUR SPECIAL RATES FOR INSTALLERS.
Prices might vary at time of publication of this magazine due to the monetary market. DELIVERY INSTRUCTIONS: ADD PACKING AND POSTAGE

PAYMENT WITH ORDERS/C.O.D. VIA AUST. POST

STANDARD MAIL AS PER P&P.
 ROAD FREIGHT—AS PER COMET CHARGES.

We have DJ Bins, Consoles, Optikinetics, Clay Paky, Coemar, A.C.R., Perreaux, Gamma, Ice, Kremesa, RCF, Piezo, Etone and many other products.

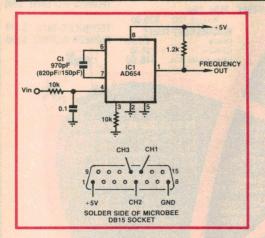
Bands need visual show. Don't be left behind. All the gear on this page will help you make it to the top!

* * Try it by hiring it * *

Do you want to be an agent? Overseas or interstate

Circuit & Design Ideas

Interesting circuit ideas from readers and technical literature. While the material has been checked for feasibility, the circuits have not been built and tested by us. As a consequence, we cannot accept responsibility, enter into correspondence or provide constructional details.



Precision V/F Converter

Here is an inexpensive method of implementing a multi-channel data aquisition system with high accuracy for the Microbee computer.

It uses an Analog Devices AD654 voltage to frequency converter which converts a 0 to 1V analog signal to a 0 to 10kHz frequency. The frequency range is set by capacitor CT across pins 6 and 7 of IC1. The necessary connections for three such channels to the Microbee DB15 socket are shown in the accompanying diagram; ie, channel 1 connects to pin 13, channel 2 to pin 5, and channel 3 to pin 12.

The program reads each channel every three minutes and provides a frequency reading from the converter. Channel 1 data is printed at line 250, channel 2 data at line 280, and channel

```
00100 READ X, Y: REM START, SIZE
00110 PRINT "@ ", X, Y, " BYTES"
00120 FOR Z=1 TO Y: READ W: POKE X+Z-1, W: NEXT Z
00130 DATA 0,40,245,213,229,62,255,211,1,211,1,6
00140 DATA 0,17,0,112,33,0,0,219,0,230
00150 DATA 1,184,1,0,0,203,17,9,71,27
00160 DATA 122,179,32,239,68,77,225,209,241,201
00170 REM
00180 INPUT "DO YOU WANT TO CALIBRATE Y/N?", Q1$
00190 IF Q1$="Y" OR Q1$="Y" THEN GOTO 200 ELSE GOTO380
00200 INPUT "PROBE ON REF 1.000V <RET", 12$
00210 R=USR(0): PRINT "FREQ ";R;" HZ = 1.000V"
00220 REM
00230 PRINT"CH 1 ";
00240 T1=FLT(USR(0))/FLT(R)
00250 PRINT [F6.1 T1], "DEG C"
00260 POKE 20,2:PRINT "CH 2 ";
00270 T2=FLT(USR(0))/FLT(S)
00280 PRINT [F6.1 T2], "DEG C"
00290 POKE 20,4 : PRINT "CH 3 ";
00300 PRINT [F6.1 FLT(USR(0))/FLT(T)], "VOLTS"
00310 REM
00320 FOR J=1 TO 46
00330 FOR I=1 TO 1016 : NEXT I
00340 NEXT J
00350 REM
00360 POKE 20,1: REM BACK TO THE FIRST CHANNEL MASK
00370 PRINT: GOTO 230
00375 REM
00380 R=7000 :S=6980:T=6990: GOTO 230
00390 END
```

3 data at line 300.

Note that the data can be scaled so that, for example, if a 10mV/°C source is used for channel 1, then the value can be scaled for a direct °C reading by multiplying T1 in line 250 by 100. In other words, T1 in line 250 is replaced by 100*T1.

For calibration, a 1.000V source is applied to the input of each converter in turn and the calibration program run starting at line 180. To access each

channel, the POKE 20,1 statement at line 360 is changed. Use POKE 20,1 for channel 1, POKE 20,2 for channel 2 and POKE 20,4 for channel 3.

The frequency for the 1.000V input will be printed as shown in line 210. The calibration frequency should be entered at line 380. R is the calibration number for channel 1, S for channel 2 and T for channel 3.

G. Guttridge, Wanniassa, ACT.

\$15

Nicad Charger with Auto Float Charge

This charger is designed to operate from 12VDC, making it suitable for recharging batteries or cells from a boat or car battery. Up to six cells can be charged in series. When charging is complete, the charger stops the cells from self-discharging by supplying a trickle charge to the nicads.

Initially, with the 12V battery connected and no nicads connected, the yellow trickle LED will light. Once the nicads are inserted, the red charge LED will light and extinguish after the nicads are charged. The yellow LED will again light to indicate that charging has

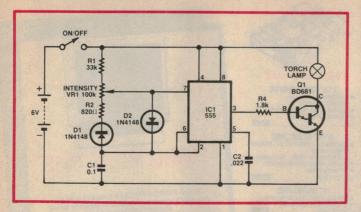
ceased and that trickle charging has begun.

Q1, R1 and LED 1 form a constant current source supply for charging. It operates as follows: LED 1 is lit via the current through R2, providing a 2V drop across the LED. The voltage across the base emitter junction of Q1 is 0.6V and this leaves 1.4V across R1.

Thus, when R1 is 27Ω , the current through Q1 is 1.4/27 = 52mA. Similarly when R1 = 12Ω , the current is 116mA. These two currents correspond to the 14-hour charge rate for AA cells and C and D cells respectively.

IC1 is used to switch off the charger once the nicads are charged. It does this by monitoring the nicad voltage at the inverting input, pin 2. The non-inverting input is connected to a reference voltage set by 10V zener D2 and trimpot VR1. VR1 is set to the fully charged potential of the cells.

When the nicads are charged, the output of IC1 goes low and switches on the yellow LED (LED 2). The resulting 2V across LED 2 turns on transistor Q2 via R3 and turns off LED 1. With LED 1 off, the voltage across R1 is reduced, limiting the charging current to about



Brightness control for torches

Here is an efficient method for controlling the brightness of an Eveready Dolphin hand-held torch.

The circuit uses a 555 timer with adjustable duty cycle to drive the torch light bulb. The range of dimming is from about 99% duty cycle for full brightness down to about 30% duty cycle. By using the lower settings, you can dramatically increase the life of the battery.

IC1 is connected as an astable oscillator with two separate paths for charging and discharging the timing capacitor C1 at pins 2 and 6. When C1 is charging, diode D2 conducts and charging is via R1 and the top portion of VR1. Conversely, during the discharge cycle, D1 conducts and discharges C1 through R2 and the bottom portion of VR2.

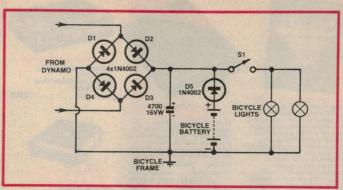
When the wiper of VR2 is toward R1, the pin 3 output of IC1 is high for about 30% of the time and when the wiper of VR1 is toward R2, the pin 3 output is high for about 99% of the time. VR2 allows adjustment between these two extremes.

The pin 3 output of IC1 drives NPN Darlington transistor Q1. Thus, when pin 3 is high, Q1 switches on the torch lamp.

Some modifications are required to the torch in order to mount the controller. A lead for the positive rail can be soldered to the lamp side of the on/off switch while the other side of the lamp needs the connection broken between it and the battery negative. Q1 connects across this break, with the emitter to the negative side of the battery.

T Hand, Bentleigh, Vic.

\$10



Battery Backup for Bicycles

Lighting for bicycles which are powered from a dynamo are liable to vast variations in lamp brightness, especially at slow speeds. At standstill, the lights go out completely and this lack of visibility can be dangerous, particularly in a poorly lit street.

The alternative is to use batteries for lighting so that the lamps remain lit even when stopped. The problem with this is that the batteries require frequent replacement.

This battery backup circuit combines the advantages of both battery and dynamo lighting. The lights are normally powered from the dynamo, with battery power taking over only when the bicycle is stopped or moving at slow speeds. This conserves the batteries.

Diodes D1 to D4 full wave rectify the AC output from the dynamo and this is smoothed to DC using a 4700μ F capacitor. The bicycle battery is isolated from the dynamo supply using D5. The diode only conducts and powers the lights when the generated DC voltage falls 0.6V below the battery voltage.

Installation involves insulating the dynamo from the frame of the bicycle using a rubber or plastic bush around the frame before clamping the dynamo in place. A wire connection is needed from the dynamo body as well as from the normal dynamo screw terminal. These two leads connect to the D1 to D4 bridge rectifier.

A standard battery-powered front lamp can be used to hold the battery and this should be modified to include diode D5. Similarly, a battery-powered rear light can be used to hold the 4700μ F capacitor and bridge rectifier.

G. Reeve, Craigie, WA.

\$10

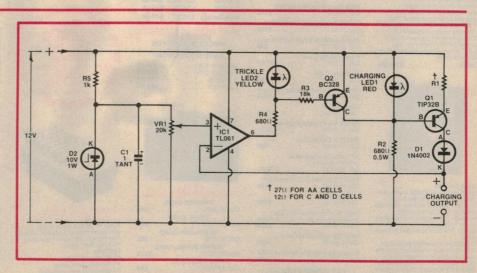
60% of normal. This trickle charges the nicads.

To adjust VR1, initially turn it fully in the direction of the zener diode cathode. Now charge the nicads for 14 hours and turn VR1 back until the yellow and red LEDs are both just lit. With VR1 left in this position the red LED will extinguish after several minutes.

Note that VR1 will require readjustment if more or less cells are to be charged.

P. Boyle, Edithvale, Vic.

\$20





UNDERSTANDING UNIX
James R. Groff, Paul N. Weinberg
The exploding popularity of the
UNIX operating system is one of the
most important trends in computing
in the 1980's. UNIX is available on
hundreds of different computers,
ranging from personal computers to
mainframes and supercomputers to
mainframes and supercomputers to
mainframes and supercomputers an
overall perspective on UNIX,
including a discussion of where
UNIX fits in the worlds of computing,
business, and education. Individual
chapters address the UNIX structure,
file system, multiuser capability,
specific applications tools, and

more.
"A book that balances scope with depth; comprehensiveness with depth; depth; Cat.B comprehensivo." -Alan Kaplan \$44.95



PASCAL PRIMER

-Mitchell Waite, David Fox
If you are learning programming or
have dabbled in the popular
language BASIC and wish to learn
the capabilities of Pascal, this book
is definitely written for you. Written
the capabilities of Pascal, this book
is definitely written for you. Written
describes Pascal program structure,
Pascal variables, Pascal procedure,
and many other features. There are
chapters or decision making
string functions, arrays and sets, and
much more. The eight appendices
present facts about the advantages
and disadvantages of Pascal,
components of a Pascal system,
inferfacing assembly language
routines, and other useful
information.

Cat. B. \$24,95 Cat.B \$24.95



CP/M PROGRAMMER'S

\$39.95 Cat B



"C" SELF STUDY GUIDE

Jack Purdum
Learn at your own pace as this self directed study guide takes you through the basics and into advanced areas of the C programming language. The unique format allows you to advance quickly or proceed slowly. The book is divided into two parts:

slowly. The book is divided into two parts:
Questions: of varying degrees of difficulty to guide beginners over the rough spots and to challenge the more experienced C programmers. Answers: that include many complete programs for testing new functions and for illustrating tips, traps, techniques and short cuts.

Cat.B. \$37.95



IBM* COMPATIBLE DISK DRIVES

Tired of paying out more for Japanese Disk Drives? These "direct import" Hong Kong disk drives are the solution! They feature Japanese mechanical components, yet cost only a fraction of the price! Cat.No. Description Price C11801 500K Normally \$199 SPECIAL, ONLY \$179 C11803 1 M/Byte . C11805 1.6 M/Byte \$239

20 M/BYTE HARD DISK DRIVE FOR IBM* AND

SPECIAL, ONLY \$950

IBM* XT COMPATIBLE CARDS

Floppy Disk Drive Controller Card (2 Drives, 16 Bit) Cat. X18005 \$129

High Resolution Mono Card Cat. X18007 \$199

Colour Graphics & Printer Card Cat. X18010 \$169

768kB RAM Card (without memory) Cat. X18012 \$99

XT Motherboard (without memory) Cat. X18020 \$225

RS232 Card (without cable) Cat. X18026\$79.50 RS232 & Clock Card Cat. X18028

Multi I/O & Disk Controller Card Cat. X18040 \$199

768K Multifunction I/O Card (includes cable but not 41256 RAM) Cat. X18050 \$199

Hard Disk Controller Card Cat. X18060\$299

Enhanced Graphics Adaptor Card Cat. X18070\$499

(AT COMPATIBLE)

Enhanced Graphics Adaptor Card

XT Turbo Motherboard (without memory) Cat. X18030

Printer Buffer Card Cat. X18017

Game I/O Card Cat. X18019

Clock Card Cat. X18024

I/O Plus Card Cat. X18045

(Award Bios) Cat. X

\$129

\$175

\$39.50

\$59.50

\$275

\$139

\$495

Colour Graphics Card Cat. X18002

Graphics Card (Hercules compatible) Cat. X18003



CANON A-40 PRINTER • Serial Impact Dot Matrix • 140 C.P.S

Near Letter Quality Mode
1.4K Buffer

\$595 Cat. C20040



CENTRONICS GENDER

CHANGERS

Female to Female.
Saves modifying or replacing non-mating Centronics cables.
All 36 pins wired straight through.

Cat. X15663 Male to Male Cat. X15661 Male to Female Cat. X15664 Female to Female

Normally \$33.95, Only \$24.95



NEC DISK DRIVES

31/2" DISK DRIVE

 1 M/Byte unformatted, (640K formatted),
 Double sided, double density,
 Access Time 3m/sec \$265

51/4" SLIMLINE

5 1/4" SLIMLINE
Switchable 1.6 M/Byte to 1 M/Byte unformatted
1.2 M/Byte to 720K formatted
Double sided, double density,
AT compatible
Cat. C11906 \$295

8" SLIMLINE

\$795





51/4" DISK SPECIALS!

All prices 10 disk boxes! XIDEX 1-9 10+ \$29.95 \$28.95 S/S D/D D/S D/D \$38.95 High Density \$79.95 \$69.95 VERBATIM DATALIFE S/S D/D \$27.95 \$26.95 D/S D/D \$34.95 \$32.95 High Density \$59.95 \$49.95

Verbatim

31/2" DISK SPECIALS! STOP PRESS! PRICES SLASHED ON 31/2" DISKS! SAVE \$10 PER BOX!!

\$54.95 \$59.95 \$55.95 \$69.95



COMPATIBLE CARDS PRINTER CARD

Cat. X17029 \$89 DRIVE CARD \$79 80 COLUMN CARD Cat. X17025 SUPER SERIAL CARD
Cat. X17035 \$129 RGB CARD Cat. X17039 \$79 PAL COLOUR CARD **Z80 C/M CARD**Cat. X17041

51/4" DISK STORAGE Efficient and practical. Protect your disks from being damaged or lost! Features... • 70 disk capacity • Smoked plastic cover • Lockable (2 keys supplied) • Diviters/inapers

Lockable (2 keys supplied)
 Divíders/spacers
Cat. C16025 only \$19.95





JUMBO 51/4" DISK

If you've got lots disks, you'll appreciate the extra capacity of this disk storage unit when it comes to locating "that" disk!

100 disk capacity
 Smoked plastic cover

Lockable (2 keys supplied)9 Dividers/spacers

C16020 only \$24.95 C16027 (Hinged Lid) \$26.95



PAPER TAMER

PAPEN IAMEN

Restores order to the top of your desk or work area

Made of white plastic coated steel

Stores up to 900 continuous sheets

Allows perfect paper feed

Allows easy examination of print out

C21050 (10") only \$49.95 C21050 (15") only \$79.95 C21050 (15")



2 & 4 WAY RS232 DATA TRANSFER

RS232 DATA TRANSFER SUTCHES

WITCHES

If you have two or four compatible devices that need to share a third or fifth, then these inexpensive data transfer switches will save you the time and hassle of constantly changing cables and leads around.

No power required

Speed and code transparent

Two/Four position rotary switch on front panel

Three/Five interface connections on rear panel

on rear panel
Switch comes standard with female connector

2 WAY Cat.X19120 \$125 \$95 4 WAY Cat.X19125 \$145 \$135

2 & 4 WAY
CENTRONICS DATA
TRANSFER SWITCHES
Save time and hassies of constantly
changing cables and leads around
with these inexpensive data transfer
switches. These data switches
switches are see data switches
switches. These data switches
taged to the see the switches
be data switches
to the switches around
the switches around
the switches

on rear panel
Switch comes standard with female connector
Bale locks are standard

2 WAY Cat.X19130 \$125 \$95 4 WAY Cat.X19135 \$145 \$135



1.111.11

INTRA 14" RGB

HIGH AT HIGH COLOUR MONITOR COLOUR MONITOR COLOUR MONITOR COMPATIBLE WITH BIRTH AND COMPATIBLE AND A STATE OF THE AND A STATE O

INTRA 14" RGB COLOUR MONITOR Resolution: 640 x 200 dots Display Format: 80 x 25 characters Display Colours: 16

Display Corours.

Dot pitch: .39mm
Sync Horiz. Scan Freq: 15.75 KHz
Sync Vert. Scan Freq: 50Hz
Band Width: 18MHz

Cat. X14514

Cat. X14520

Our price \$995

\$695

Rod Irving Electronics

48 A'Beckett St, MELBOURNE Phone (03) 663 6151 425 High St, NORTHCOTE Phone (03) 489 8866

Mail Order and Correspondence P.O. Box 620, CLAYTON 3168 Telex: AA 151938



008 335757 (TOLL FREE) LOCAL: 543 7877

POSTAGE RATES:	
\$1 - \$9.99	\$2.00
\$10 - \$24.99	\$3.00
\$25 - \$49.99	\$4.00
\$50 - \$99.99	
\$100 - \$199	\$7.50
\$200 - \$499	\$10.00
\$500 plus	\$12.50
FREE POSTAGE FOR ORD	ERS
OVER \$75 & UNDER 3KG	GII

Certified Post for orders over

All sales tax exempt orders and





ectronics herals!



Now you can buy absolute top quality 51/4" disks that are also the cheapest in Australia!! They even come with a 5 year guarantee, which indicates the quality of the Microdot disks. So why pay 2-3 times the price for the same quality as Microdot?

1-9 BOXES 10+ BOXES

5¹/₄" S/S D/D \$14.95 \$13.95 D/S D/D \$18.95 \$17.95

(SEND \$2 FOR SAMPLE DISK!)

51/4" D/S"NO FRILLS" DISKS FROM \$1 EACH!!

Bulked packed, Microdot D/S D/D without boxes, or labels, or brand name, just their white card jacket!

1-99 DISKS

100+DISKS

1,000+DISKS

(SEND \$2 FOR SAMPLE DISK!)

(TAX EXEMPT PRICES LESS 20¢ PER DISK)

Bulked packed, D/S D/D disks with white boxes, but no labels or brand name. (These are a top name brand, but we can't tell you which.)

1-99 DISKS

100+DISKS

1.000+DISKS

\$47.50 (PER 10 DISKS)

(PER 10 DISKS)

(PER 10 DISKS)

(SEND \$5 FOR SAMPLE DISK!)

(TAX EXEMPT PRICES LESS 40¢ PER DISK)

200W Power Supply

6 Months Warranty

Check these features and our prices. We're sure you'll agree they're exceptional value for money!

- Assembled & Tested in Australia!
- Tested by us for 24 hours prior to delivery!
 AT style keyboard
- 8 Slot motherboard
- Operating manual
- 150W power supply 6 Months warranty!
 - (Japanese drives available for an extra \$50 each)

* \$795 COMPATIBLE COMPUTER

256K RAM Single Drive, Graphics and Disk Controller Card.... \$795

256K RAM COMPATIBLE COMPUTER

2 x 360K Disk Drives, Multifunction Card, Colour Graphics, Disk Controller, 1 Parallel Port. (Includes Timer Disk) \$1,095

640K RAM COMPATIBLE COMPUTER

2 x 360K Disk Drives, Multifunction Card, Colour Graphics, Disk Controller, 2 Serial, 1 Parallel Port. (Includes Timer Disk)

..... only \$1,195

• 6 MHz

- 1 M/Byte Main Board
- 1.2 M/Byte Floppy Disk Drive
 Colour Graphics Display Card
- Floppy & Hard Disk Controller Card
 20 M/Byte Hard Disk Printer Card and RS232
- 80286 CPU
- 8 Slots
- Keyboard

..... only \$3,695

RETAIL INQUIRIES: Rod Irving Electronics,

MELBOURNE, 48 A'Beckett St. Phone (03) 663 6151 NORTHCOTE 425 High St. Phone (03) 489 8866

MAIL ORDER: (03) 543 7877 or P.O. Box 620, CLAYTON 3168

WHOLESALE INQUIRIES: Ritronics Wholesale, 56 Renver Rd. CLAYTON 3168. Phone (03) 543 2166.

008 335757 TOLL FREE MAILORDER HOTLINE FOR CREDIT CARD ORDERS!!

Estimating noise in op amp stages

Estimating the noise performance of an op amp stage is easy with a little circuit analysis and a short BASIC program to take care of the maths. The program requires only two resistance values and a figure for bandwidth to compute the noise levels for six popular op amps.

by PHIL ALLISON

There are several sources of noise in an op amp stage which together account for the total background hiss level. These are the op amp itself (particularly the active devices employed in the input stage), the resistors used for gain setting, and the noise generated by the resistance of the signal source.

It must be appreciated that any resistor has a self noise level caused by thermal agitation of its free electrons. This noise, commonly known as white noise, is random and spreads across the whole frequency spectrum. Its magnitude is given by a simple formula:

where

En = RMS noise voltage

 $L = Boltzmann's constant 1.38 \times 10^{-23}$

T = temperature in degrees K (degrees C + 273)

B = bandwidth of measurement

R = resistor value in ohms

For example: a $10k\Omega$ resistor at room temperature and measured with a 20kHz bandwidth will generate a noise voltage of $1.8\mu V$. (Try some other values on your calculator to get a feel for the quantities involved).

The program presented here can be used to select the best op amp for a given application or to examine the effect on noise performance of design changes to a circuit.

Before the program can be used, two resistance values must be derived from the circuit of the op amp stage in question. These I have called *source resistance* and *input resistance*. The first is

just the value in ohms of the internal resistance of the device generating the input signal.

For example, for a 200-ohm microphone use a value of 200 for the source resistance, and for a high impedance microphone (internal step-up transformer type) use a value of 50,000. If noise testing is to be done with the input shorted then use a value of 1 (one ohm) as the program will not accept a value of 0.

Input resistance

The input resistance has to be determined from the circuit of the gain stage in question and here a little analysis is needed. Note that the input resistance is not the same as the input impedance for the circuits of Fig. 1 and Fig. 2.

There are two common types of op amp gain stages: (1) the inverting stage as shown in Fig.1; and (2) the noninverting stage as shown in Fig.2. The input impedance of the inverting type is equal to R1, while the input impedance of the non-inverting type is equal to Rin

INPUT R1

RS

R2

Fig. 1

Fig.1: inverting op amp stage. Gain = R2/R1.

and may be almost any value. The signal gains of these two stages are given by the formulas beneath each diagram.

Don't worry if your circuit has capacitors in series with the input or feedback ground (Fig.2) as normally these can be neglected.

In Fig.1, the input resistance is equal to R1 in parallel with R2. If R2 is more than ten times R1, then just use the value of R1.

For Fig.2, the input resistance is the same as for Fig.1 (ie, R1 in parallel R2), but if Rin is less than ten times R1 then calculate Rin in parallel with R1 and R2 as well. If there is a resistor in series with the input, add this to the input resistance.

The figure for bandwidth can be any value up to the circuit bandwidth. For audio purposes, a figure of about 16kHz is commonly adopted for specifications.

The program will, in a couple of seconds, compute the equivalent input noise (EIN) and noise figure for six op amps. Other op amps can easily be added to the list.

The EIN is a standard way of specifying input stage noise as it is independant of the overall gain. If you multiply the EIN figure by the gain of the stage, then you will have the noise voltage expected at the output.

The noise figure is also calculated so that the standard of performance of a circuit can be seen at a glance. It compares the stage in question with an imaginary noiseless stage and quotes the difference in decibels. A figure of 1dB would be very good and hardly worth trying to improve upon. This figure is

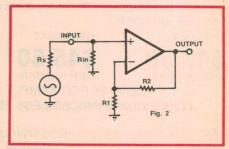


Fig.2: non-inverting op amp stage. Gain = (R1 + R2)/R1.

```
10 CLS: PRINT
           PROGRAM TO CALCULATE NOISE"
20 PRINT"
25 PRINT"
                  IN OP AMPS"
30 PRINT"
40 PRINT
                               "; RS: PRINT: IFRS=OTHENSO
50 INPUT" SOURCE RESISTANCE
                              "; RI: PRINT: IFRI=OTHEN60
60 INPUT" INPUT RESISTANCE
70 INPUT" NOISE BANDWIDTH KHZ "; BW: PRINT: IFBW=OTHEN70
71 PRINT
100 DATA 3.5E-9.4E-13.1E-8.5E-13.1.8E-8.1E-14
110 DATA 1.5E-8,1.7E-13,2.2E-8,6E-13,4.7E-8,1E-14
115 RESTORE
120 FORI=1TO6: READ EN, IN
140 KT=4.1E-21
150 ET=((EN^2+IN^2*(RS^2+RI^2)+4*KT*(RS+RI))*BW*1E3)^0.5
160 IFI=1THENPRINT"
                      NE5534 "::GOTO300
170 IFI=2THENPRINT"
                      RC4558 ";:GOTO300
180 IFI=3THENPRINT"
                      TLO71 ";:GOTO300
                      LM301A "; : GOTO300
190 IFI=4THENPRINT"
200 IFI=5THENPRINT" UA741C "::GOTO300
                      TLO81 ";:GOTO300
202 IFI=6THENPRINT"
300 PRINTUSING"###.##"; ET*1E6; : PRINT" UV ";
310 NS=(4*KT*BW*1E3*RS)^0.5
320 NF=20*LOG((ET/NS))/LOG(10)
330 PRINTUSING" ##.#"; NF; : PRINT" DB"
340 NEXTI
350 PRINT" =======================
360 INPUT"RTN"; A: IFA=0SOUND21, 1: GOTO10
```

independent of gain, bandwidth and signal level.

Low noise tips

To optimise a design, the value of input resistance must be kept as low as possible. For an inverting stage, this is limited by the minimum acceptable input impedance. There is no such problem with the non-inverting stage, making it the preferred type for low noise stages. Most op amps will drive loads down to 1000 ohms or so, hence R1 plus R2 can equal this. The NE5534 can drive loads down to 600 ohms.

Don't worry about using expensive "low noise" resistors as these make no difference in an op amp stage where there is little or no DC across the resistors. Noise caused by a large voltage across a resistor is called excess noise and varies widely with resistor type.

Using the program

The formula for noise in the program appears in line 150. This sums all the noise sources involved using the published data for each op amp in turn and

the result is quoted in microvolts. This data appears in lines 100 and 110 as EIN voltage and EIN current figures in volts and amps per Hz respectively. Line 320 computes the noise figure by dividing the result of line 150 by the noise of the source resistance and converting this to decibels.

When return is pressed the program runs again so that you can enter new values.

Due to device variations and the use of averaged values in the EIN data, the computed figures are not precise but are close enough to measured results to allow valid comparisons between circuits and op amps.

The program was written for a VZ300 computer but should work with little alteration on almost any computer running BASIC.

References

R.A. Fairs, Resistor Survey. Wireless World, October 1975.
Walter G. Jung, IC Op Amp Cook-

Left: this program was written for the VZ300 computer but should work with little alteration on almost any computer running BASIC. The program runs each time return is pressed, so that you can enter new values.

Below: these sample screen printouts show the results for six common op amps for various circuit conditions. The program calculates both the equivalent input noise (in microvolts) and the noise performance (in dB).

		-		
SAMPLE	s	CR	EEN	s
SOURCE RESIS	TANC	E	? 200	
INPUT RESIST	ANCE		? 47	
NOISE BANDWI	DTH	KHZ	? 16	
NE5534 0 RC4558 1 TL071 2 LM301A 1 UA741C 2 TL081 5	.29 .29 .91 .79	UV UV UV	18.4 21.7 28.3	DB DB DB DB
SOURCE RESIS				
INPUT RESIST			? 100	U
NOISE BANDWI	DIR	KH2	. 10	
LM301A 2 UA741C 3	.97 .70 .39 .18	UV UV UV	4.9 7.4 13.1	DB DB DB DB
SOURCE RESIS	TANC	E	? 1E5	
INPUT RESIST	ANCE		? 1E4	
NOISE BANDWI	DTH	KHZ	? 2.5	
TLO71 2 LM301A 2 UA741C 3 TLO81 3	.33 .31 .41 .85	UV UV UV	3.2 4.3 1.1 1.5 5.6 3.9	DB DB DB DB DB

An introduction to hifi, Pt.12

AM radio tuners

Background, fidelity, problems, stereo

While radio may be seen by many as a utility service for a non-critical mass audience, it has the potential to deliver better than average quality sound to listeners who are prepared to install a better than average quality tuner or receiver. In this chapter, we look particularly at stereo AM broadcasting.

by NEVILLE WILLIAMS

A radio frequency carrier may be "modulated", or have an audio signal imposed on it in a variety of ways, the original and most common method being amplitude modulation (AM) as illustrated in Fig.1. When an audio signal (a) is amplitude modulated on to a radio frequency carrier (b), the modulated carrier takes on the form depicted in (c), its amplitude varying in sympathy

Fig.1: when an RF wave (b) is amplitude modulated by an audio signal (a) the modulated waveform mirrors the shape of the audio envelope, as shown in (c).

with the instantaneous amplitude of the audio waveform.

While most readers will be familiar with Fig.1, not everyone may realise that, by its very nature, the process of modulation generates additional high frequency signal components distributed (usually) on either side of the original carrier frequency.

In the case of normal amplitude modulation, every frequency component in the audio waveform generates a pair of these so-called "sidebands", one to either side of the carrier and displaced from it by an increment equal to the particular modulating frequency (Fig. 2).

A bass note of, say, 64Hz would produce a pair of sidebands respectively 64Hz to either side of the carrier. With a 4096Hz treble note, the sidebands would be displaced to either side by 4096Hz or 4.096kHz. In practice, with a complex music signal, there will be a similarly complex pattern of sidebands present, extending out to 10kHz or more on either side of the carrier and occupying a total bandwidth of (typically) 20kHz.

To receive the total signal being radiated by an amplitude modulated broadcast transmitter, the tuning circuits in a receiver should be so designed that they will accept the full spectrum of sidebands. At the same time, however, they are expected to discriminate against unwanted signals being radiated from

other stations broadcasting on adjacent carrier frequencies.

Here lies a problem. Only so much spectrum space is available for use by "medium wave" broadcast stations in the allotted frequency range from (approx.) 525 to 1600kHz. Over 250 stations have to be accommodated in this space in Australia (in other countries, the situation is similar) operating on channels only 9kHz apart, with many geographically isolated stations actually having to share channels.

Particularly at night, with mediumwave transmissions tending to spread across the continent — and the Tasman — distant signals can interfere with anything but strong local stations, particularly with wideband receivers.

As well, adjacent carriers tend to beat or heterodyne, to produce a continuous 9kHz whistle. To overcome this problem, wideband receivers need to be fitted with a special 9kHz whistle filter. (In the USA, AM stations are still 10kHz apart, so that their tuners need 10kHz filters).

As far back as the 1930s, with the number of AM broadcast stations just

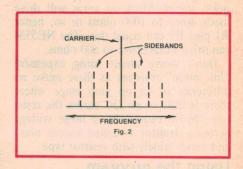
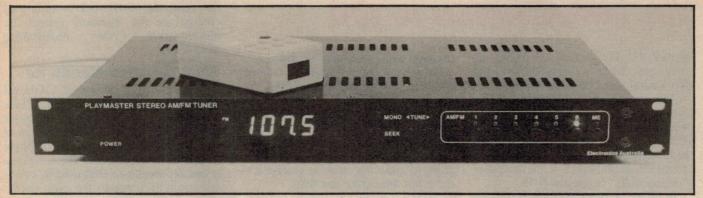


Fig.2: unlikely as it may seem an amplitude modulated waveform is made up of the original carrier plus pairs of sidebands, one pair for each frequency component in the audio signal.



This high performance Stereo AM/FM Tuner from *Electronics Australia* features wideband stereo AM reception, 12-station memory, remote control and synthesised tuning.

beginning to multiply, listeners were demanding more "selective" receivers to ensure freedom from inter-station interference and inter-carrier whistles – irrespective of the fact that it meant attenuating the outer sidebands of the wanted station and thereby sacrificing treble response.

And that's the way it still is, with the vast majority of AM broadcast band receivers and tuners cutting heavily into sidebands beyond about ±3kHz, with a consequent loss of treble response above that figure.

But, back in the 1930s, there was also a genre of more discerning listeners who preferred non-selective receivers, reckoning wideband reception of local broadcasters to be more important than the ability to receive distant stations that were seldom listened to anyway!

Early receivers — the TRF

A type of receiver much favoured for this purpose was the so-called TRF (tuned radio frequency) design, as illustrated in Fig.3. It most commonly involved two RF amplifiers, followed by a detector, with the inputs to all three stages being tuned to the frequency of the desired station by means of matched tuning coils and a 3-gang variable capacitor.

While TRF receivers gave a wider bandwidth of sorts, the basic selectivity curve was of questionable shape (solid curve, Fig.4). The "nose" of the curve was often sufficiently peaky to prejudice the sidebands while, at the same time, the wide "skirts" could let strong interfering signals through that would otherwise not be a problem.

To make matters worse, the tuning circuits invariably tended to exhibit a narrower bandwidth at the low frequency end of the band, where most major national stations were to be found, and a wider bandwidth at the high frequency end, where greater se-

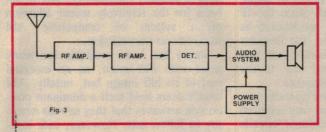


Fig.3: popular in the 1930s, a simple TRF receiver offered wideband reception under favourable conditions but was unduely prone to interference from strong signals on nearby channels.

lectivity would have been more appropriate!

Even so, TRF receivers generated a cult following and there were countless arguments in the technical press as to their merits. However, their inadequacies became more apparent as the number of stations increased. Nowadays, the principle is seldom mentioned.

Superheterodyne receivers:

A more practical and now universal type of receiver is the superheterodyne — or "superhet" — configuration as illustrated in Fig.5. The incoming signal passes through a tuned RF amplifier or, more simply, through a simple tuned circuit to a frequency changer or converter section.

Here, it is heterodyned or mixed with a locally generated signal from an inbuilt oscillator stage. The circuitry controlling the oscillator frequency is so ar-

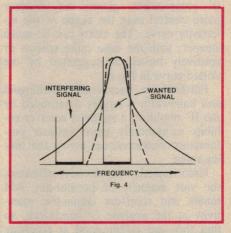


Fig.4: the selectivity curve shown solid is doubly unacceptable. Its sharp "nose" seriously attenuates the outer sidebands but, at the same time, the wide "skirts" invite interference. A blunt, more rectangular curve (dotted) is much better in both respects.

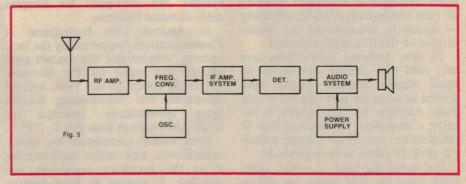


Fig.5: virtually all tuners and receivers produced during the past 40 years or more have used the superheterodyne principle, although the execution of the circuit looks very different in the modern crystal-locked synthesised form.

An introduction to hifi

ranged that the local signal fed to the frequency changer always differs from the wanted signal by a specific figure.

The convention in AM broadcast receivers is to run the oscillator above the selected incoming frequency by around 455kHz so that, when the two signals heterodyne or "beat", a resultant is produced at 455kHz — the so-called "intermediate" frequency or IF.

In effect, a superheterodyne receiver changes each incoming signal, as it is selected, to the intermediate frequency, passing it through a pre-tuned IF amplifier system to a detector. Since the IF signal carries the same modulation as the original radio carrier, the detector can isolate the audio component and pass it on, in the normal way, to the audio amplifier and loudspeaker.

Because the IF amplifier operates at a fixed frequency, it can use any required number of pre-tuned resonant circuits or components, giving the designer more control over the shape of the selectivity curve. The skirts can be much steeper, with the nose quite narrow or relatively broad, as suggested by the dotted curve in Fig.4.

Furthermore, because the overall gain and bandwidth is largely determined by the IF amplifier, a superhet receiver exhibits substantially more uniform performance characteristics across the tuning range.

Unfortunately, as already indicated, the vast majority of present-day AM tuners and receivers emphasise selectivity at the expense of bandwidth, so that they are rather good at receiving stations under difficult reception conditions but rather poor in terms of high frequency audio response.

Efforts have been made, from time to time, to promote designs with the emphasis the other way round, or which offer broad/narrow bandwidth switching or even continuously variable selectivity — mainly by manipulating the characteristics of the IF amplifier channel.

To date, however, such efforts have met with only limited success, in no small degree because buyers have tended to judge the performance of AM radio receivers on their ability to receive a multiplicity of stations, free of interference, not on an obscure technical attribute called audio bandwidth!

Old habits die hard, it would seem. Fifty years on, AM radio has still to shed its utility image as a vehicle for instant news, information, sport, enter-

tainment and "wallpaper" music.

Fortunately, even though the majority of tuners and receivers have been narrow-band designs, AM radio stations have continued to radiate program material extending out to a nominal 10kHz, so that better quality AM sound has long been accessible to anyone prepared to make the effort to receive it—and a few have done just that!

Stereo AM radio

This general situation could well have continued indefinitely, had it not been for the relatively recent adoption of a system of compatible AM stereo/mono transmission.

Stereo has been available for many years with FM radio, as an essential part of its hifi image but, initally, AM broadcasters held such a dominant position on airwaves that they saw no necessity to follow suit. However, with leading FM stations clawing their way to the top, in terms of audience share, the AM stations obviously had to polish up their act.

With the AM system, compatible mono/stereo posed considerable difficulty at both the transmitting and receiving end but, in the mid 1970s, when the FCC (the US Federal Communications Commission) addressed itself to the matter, no less that five rival systems were available for evaluation: Harris, Kahn/Hazeltine, Magnavox, Motorola and RCA/Belar.

After due consideration and testing, the FCC designated the Magnavox system as the provisional standard for the USA. However, faced with possible legal challenge by the losers, it set aside the decision in March 1982, leaving the matter to be determined by market forces — a non-decision that could have led to multiplicity of transmission systems and the need for complex multi-standard receivers.

In Australia, the Department of Communications, supported by the local industry, decided that this was not good enough and opted for the Motorola C-QUAM system in late 1984, with all Australian AM broadcasting licences being automatically endorsed for C-QUAM stereo as from Feb.1, 1985.

Some stations commenced the service immediately, with others implementing it as the necessary equipment was installed. It appears to have been a technically sound decision, subsequently endorsed by New Zealand, and setting

the scene for C-QUAM to ultimately emerge as the standard system for medium-wave AM broadcasting worldwide.

What C-QUAM stands for

The "QUAM" portion of C-QUAM stands for QUadrature Amplitude Modulation and refers to a technique involving the use of two sub-carriers of the same frequency but with a phase difference of 90 degrees. The technique is broadly similar to that used in colour television to transmit the two chominance signals.

In the context of AM stereo, the main sub-carrier would typically be modulated by the L+R (left + right) "sum" signal, while the derived (90° phase lag) sub-carrier would accommodate the L-R "difference" signal. After summing, the sub-carrier components would be modulated on to the main carrier for transmission.

In practice, the QUAM system, as such, is not suitable for use by medium-wave broadcast stations because it would demand greater bandwidth than is available. Moreover, the transmission would not be truly compatible, because the detector in mono AM tuners would see and respond only to the vector sum of the two modulating envelopes, having a value of:

$$(1 + L + R)^2 + (L - R)^2$$

The recovered audio would be mono of a kind but characterised by gross distortion and totally unacceptable on that account. The prefix "C" in C-QUAM, signifying compatible quadrature amplitude modulation, is therefore of particular significance.

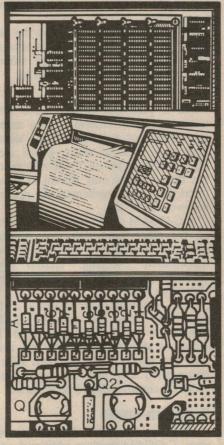
In C-QUAM there is no sub-carrier as such, the L+R and L-R components being quadrature modulated directly on to the main carrier, which is then amplitude modulated in the normal way by the L+R signal.

As indicated in Fig.6, the sum and difference signals are fed to two balanced modulators, along with a direct and a phase shifted feed from the main carrier generator, the respective outputs being combined in a summing circuit.

To overcome the stereo/mono compatibility problem, indicated above, each carrier axis is electrically multiplied by the cosine of the angle theta, representing the instantaneous vector sum of the L+R and L-R components (Fig.7).

What ultimately emerges from the summing circuit can be interpreted mathematically either as the sum of two







GET YOUR TRAINING NOW AND BE PREPARED FOR THE FUTURE

If you're interested in electronics, a Stott's Home Study Course can make it even more interesting. It could lead to an exciting career in the fast growing field of electronics.

You can start with Stott's Introduction to Electronics which gives you an understanding of the basic principles, then choose from Stott's range of electronics courses. Radio and Television Servicing, Radio Receivers, Colour Television, Introduction to Micro Computers, Digital

Electronics for Technicians & Servicemen or Industrial Electronics.

Stott's electronics courses offer plenty of practical work and 'hands on' experience through custom designed kits. You'll be skilfully guided by experienced, professional instructors, with individual attention and advice. You study at home, at your own pace.

Make your move towards a brighter future. But do it now. Send the coupon today.



PAL TRACTION TO THE MEION STATE MEION Sydner

CORRESPONDENCE COLLEGE
The name to trust in correspondence education

"Stott's Correspondence College is Australian in origin and ownership, with a tradition of nearly 80 years fine educational service to men and women throughout Australia."

Melbourne, 140 Flinders Street, 3000. Tel: 654 6211 Sydney, 383 George Street, 2000. Tel: 29 2445 Brisbane, 65 Mary Street, 4000. Tel: 221 3972 Adelalde, 226 Pulteney Street, 5000. Tel: 223 3700 W. Perth, 25 Richardson Street, 6005. Tel: 322 5481 Hobart, 150 Collins Street, 7000. Tel: 34 2399 New Zealand Rox 30-990 Lower Hutt Tel: 67 6592

WITH STOTT'S YOU CAN START ANY COURSE ANY TIME OF THE YEAR AND PROGRESS AT YOUR OWN PACE.

PLEASE SEND ME FREE, AND WITHOUT OBLIGATION, FULL DETAILS OF THE FOLLOWING COURSE:				
	(PLEASE PRINT)			
MR. MRS. MISS	(AGE)			
ADDRESS	No.			
	POSTCODE			
Stott's undertake that no sales counsellor will visit you.	ALA/ST 5959/EA487			



An intoduction to hifi

separately modulated carriers or as a single carrier with complex phase and envelope modulation. A limiter removes the envelope variation, leaving only a phase modulated signal, which can be fed to the exciter input of an existing transmitter.

The result is that, as seen by the detector in a conventional mono tuner, the resultant from a C-QUAM modulated stereo carrier cancels down to:

1 + L + R

which is precisely what a mono AM tuner expects to receive from a mono transmission of a summed stereo signal from tape, disc or other source (see Fig.7). Proponents of C-QUAM point out that it is the only system in those listed that offers mathematically precise mono compatibility.

A C-QUAM stereo tuner or receiver, on the other hand, can react to the phase components and, by reversing the transmission encoding, recover the original L & R audio signals. But more about that later.

Note also that Fig.6 shows a 25Hz pilot tone being fed into the (L-R) channel, at a 4% modulation level. It serves to alert tuners to the fact that they are receiving an adequate stereo transmission and that the appropriate decoding circuitry should be activated.

Problem areas

Because, like other AM stereo systems, C-QUAM involves additional and critical modulation components, along with the likelihood of wideband reception, some of the liberties which can be

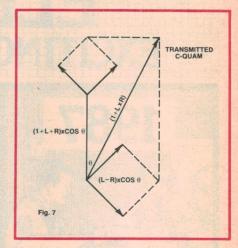


Fig.7: this vector diagram shows the sum and difference information as transmitted for stereo reception and compatible vector sum received by existing mono tuners.

taken with narrow-band mono broadcasting are no longer acceptable.

At the transmitting end, care must be taken to minimise random or incidental phase modulation (IPM) because it could be interpreted by tuners as an audio signal. In addition, the amplitude modulation of the carrier must be symmetrical, as also the amplitude and phase characteristics of the sidebands.

This calls for careful assessment and adjustment of the transmitter, consideration of the antenna feedlines and filters and of the antenna system itself. Very real problems have had to be faced by station engineers with directional and shared transmitting antenna systems, involving filters and configurations worked out before stereo was even to

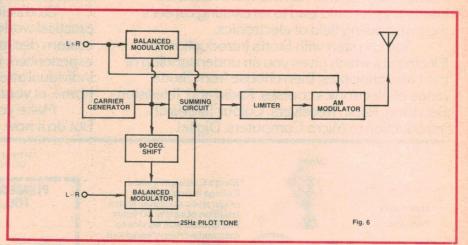


Fig.6: for C-QUAM transmission the AM transmitter remains basically intact but the carrier is effectively phase modulated in terms of (L+R) and (L-R). C-QUAM can claim complete stereo/mono compatibility provided good practice is preserved.

56 Renver Road, CLAYTON, 3168, VICTORIA, AUSTRALIA. Phone (03) 543 2166 (4 lines). Telex AA151938

N.S.W. DISTRIBUTOR: Bill Edge Electronics Pty. Ltd. 76 Porters Rd, KENTHURST 2156. Phone (02) 654 2046

Minimum account order is \$50, minimum cash sale is \$25. Minimum post/pack \$3.00 Minimum account post/pack \$5.00. Comet Road Freight, bulky items and/or over 10kg is extra



51/4" FLOPPY DISKS

Have a look at these prices!
These are 100% certified, prime spec. disks in labelled jackets.

Description 1-9 10+ 100+
Cat.No. boxes boxes boxes
S/S D/D C12440 \$14.50 \$13.90 \$13.00
D/S D/D C12445 \$16.50 \$14.90 \$13.50
Plus 20% tax where applicable

Attention Schools, Government Depts etc FREE sample disk available on request (Please send \$2 to cover postage)



RITRON II MONITORS
Swivel base monitor in stylish case.
esc/Cat.No. 1-9 10+ 50+
een Cat. X14506 5145 5135 5125
mber Cat. X14508 5145 5135 \$125
Plus 20% tax where applicable



SAMSUNG TTL MONITORS

Cat No.	Desc.	1-3	4+	
X14500	Green	\$130	\$125	
X14502	Amber	\$135	\$130	
	Plus 20% tax where	applicabl	е	

27512 4164-15P

41256 6116P-3

27256 6264 2764



Cat. No. & Desc.	1-23	100+	1000
M12851 2851 240V 12-6V CT 15	3.50 50mA	3.30	2.90
M12155 2155 240V 6-15V 1A ta		5.75	5.50
M12156 2156 240V 6-15V 2A ta		8.75	8.50
M12840 2840 240V to 9V C.T. a		3.30	3.10
M12860 2860 240V to 15V C.T.		3.30	3.10
M16672 6672 240V 15-30V 1A t		8.75	8.40
Plue 20% +	av whore	annlinah	do



12V SEALED LEAD ACID

BATTI	ERIES	
Description/Cat.No.	1-9	10+
1.2 AH S15029	\$12.50	\$11.75
2.6 AH S15031	\$17.70	\$16.50
4.5 AH S15033	\$23.40	\$22.00

PRICES!

PRICES!

"Check for the latest memory prices!"
10-99 100+ 1000+ 10K+
1052- \$24.00 \$22.00 \$22.00 \$22.00
164-15P \$2.00 \$1.70 \$1.65 \$1.60
1256 \$4.00 \$3.50 \$3.40 \$3.20
1256 \$4.00 \$3.50 \$3.40 \$3.20
1256 \$4.00 \$6.50 \$6.50 \$6.00
1169-3 \$3.00 \$2.90 \$2.20
1169-3 \$7.00 \$6.50 \$6.50 \$6.00
1169-3 \$7.00 \$6.50 \$6.50 \$6.00
1128 \$7.50 \$6.50 \$6.00 \$5.50
1128 \$7.50 \$6.50 \$6.00 \$5.50
1128 \$7.50 \$6.10 \$5.90 \$5.50
1128 \$7.50 \$6.10 \$5.90 \$5.50
1129 \$7.50 \$6.10 \$5.90 \$5.50
1129 \$7.50 \$6.10 \$5.90 \$5.50
1129 \$7.50 \$6.10 \$5.90 \$5.50
1129 \$7.50 \$6.10 \$5.90 \$5.50
1129 \$7.50 \$6.00 \$5.00 \$4.50 \$4.00
1129 \$7.50 \$6.00 \$5.00 \$4.50 \$4.00
1129 \$7.50 \$6.00 \$5.00 \$4.50 \$4.00
1129 \$7.50 \$6.00 \$5.00 \$4.50 \$4.00
1129 \$7.50 \$6.00 \$5.00 \$4.50 \$4.00
1129 \$7.50 \$6.00 \$5.00 \$4.50 \$4.00
1129 \$7.50 \$6.00 \$5.00 \$4.50 \$4.00
1129 \$7.50 \$6.00 \$6.00 \$6.00 \$6.00 \$6.00



Cat No.	1-9	10+
C12010 5" Plastic 10W Max	6.00	5.80
C12015 5" Metal 10W Max	6.00	5.80
C12012 12V Siren	9.90	9.60

DIODES

Cat No.	Descript.	10+	100+	1000+	10K	
Z10135	IN4148	0.03	0.02	0.015	.015	
	IN4002	0.04	0.03	0.03	.025	
	IN4004	0.05	0.04	0.03	.025	
	IN4007	0.10	0.06	0.05	0.04	
Z10115		0.18	0.14	0.09	0.08	
Z10119	IN5408	0.20	0.16	0.10	0.09	

GREY FLAT RIBBON CABLE

TIN 100 FOOT ROLLS

Cat No. Decc. 1-3 4-9 10-99 100+
W12614 14 Way 19-50 18-50 18-00 14-00
W12616 16 Way 21-50 19-50 19-00 16-00
W12620 20 Way 25-50 28-00 26-50 20-00
W12620 20 Way 25-50 28-00 26-50 20-00
W12620 20 Way 34-00 22-00 25-00 25-00
W12620 43 Way 44-00 42-00 39-00 34-00
W12620 43 Way 49-00 47-00 42-50 36-00
W12620 40 Way 55-00 52-50 48-50 40-00
W12620 40 Way 55-00 52-50 48-50 40-00
W12620 40 Way 55-00 52-50 58-50 50-00
LARGER QUANTITIES NEGOTIABLE!
Plus 20°Vs. tax where applicable

E-B

I

RESISTORS

1/4 Watt E12 carbon
Bulk packed \$5.25 per 1,000
Taped and boxed \$5.25 per 1,000
\$50.00 per 10K lots
1/4 METAL FILM TAPED AND BOXED
\$14.00 per 1,000 lot
\$12.00 per 10K lot
SUPPLY E24 VALUE
Plus 30% tax where applicable



20% OFF THESE PRICES!!

IDC COCKET

IDC BUCKEIS					
Cat.No. Description	1-9	10+	100+		
P12100 10 Pin	1.95	1.75	1.25		
P12101 16 Pin	2.25	2.05	1.65		
P12102 20 Pin	2.45	2.25	1.90		
P12104 26 Pin	2.65	2.45	2.00		
P12106 34 Pin	2.75	2.55	2.15		
P12108 40 Pin	2.95	2.75	2.25		
P12110 50 Pin	3.50	2.95	2.50		
Plus 20% Sales 1	ax wh	ere app	licable		

20% OFF THESE PRICES!!

UNPROTECTED

STRIP HEADERS Dual in Line 2.54mm

Cat.No. Description	1-9	10+
P12240 10 Way	1.25	1.10
P12246 16 Way	1.35	1.20
P12250 20 Way	1.45	1.25
P12256 26 Way	1.50	1.40
P12260 30 Way	1.75	1.65
P12264 34 Way	1.95	1.75
P12270 40 Way	2.25	1.95
P12275 50 Way	2.75	2.50
P12280 60 Way	2.95	2.75
Plus 20% Sales T		

IALIN	IALUM	CAPA	CITUR
Cat.No.	Description	10+	100+
R16124	4.7uF 16V	\$0.24	\$0.18
R16125	10uF 16V	\$0.25	\$0.23
R16126	15uF 16V	\$0.38	\$0.36
R16128	22uF 16V	\$0.42	\$0.40
R16132	47uF 16V	\$1.55	\$1.20
R16134	68uF 16V	\$1.80	\$1.50
R16220	4.7uF 16V	\$0.35	\$0.33
	10uF 16V	\$0.38	
	22uF 16V	\$1.20	
	0.1uF35V	\$0.13	\$0.12
	0.15uF35V	\$0.13	\$0.12
	0.22uF 35V	\$0.15	\$0.12
	0.33uF 35V	\$0.15	\$0.14
	0.47uF 35V	\$0.15	\$0.14
	0.68uF 35V	\$0.16	\$0.15
	0.82uF 35V	\$0.18	\$0.15
	1uF35V	\$0.15	
	1.5uF 35V	\$0.24	\$0.20
	2.2uF35V	\$0.24	
	3.3uF35V	\$0.29	
	4.7uF35V	\$0.35	\$0.33
	30% Sales tax		
0	o odles lax	miles app	illanie

COMPUTER CONNECTORS

Cat No. Description 1-99 100 - 1000 + 1000 + 10000 De25 Plug 1.00 0.90 0.60 1000 + 10000 De25 Plug 1.00 0.90 0.60 1000 De25 Plug 1.00 0.90 0.60 0.50 0.50 1000 De25 Plug 1.00 0.90 0.60 0.55 0.50 Pl2200 Cent. Crimp 4.50 4.00 3.50 1000 De25 Plug 1.00 0.00 0.55 0.50 Pl0880 DB9 Plug 1.30 1.20 0.90 Pl0881 DB9 Skt.1-40 1.30 1.00 Pl0882 DB15 Cover 0.65 0.55 0.50 Pl0890 DB15 Plug 1.30 1.20 0.90 Pl0891 DB15 Skt.1-40 1.30 1.00 Pl0892 DB15 Skt.1-40 1.3

CoMPUTER CC Cat No. Description P10900 DB25 Plug P10901 DB25 Std. P10902 DB25 Cover P12210 Cent. Solder P12200 Cent. Crimp P10880 DB9 Plug P10881 DB9 Skd. 1.40 P10882 DB9 Cover P10890 DB15 Plug P10891 DB15 Skd. 1.40 P10892 DB15 Cover Plus 20% tax who

VOLTAGE REGULATORS

- CAL		2 4 1 4	CI CI LI
Descript.	10+	100+	1000+
7805uC	.45	.44	.43
7805KC	1.50	1.40	1.20
7812uC	.45	.44	.43
7815KC	1.50	1.40	1.20
7818uC	.50	.49	.48
7818KC	1.50	1.40	1.20
7905uC	.70	.60	.55
7912uC	.70	.60	.55
uA323KC	4.50	3.90	3.75

T WANTED I OND					
Desc.	10+	100+	Desc.	10+	100+
2SJ49	5.50	4.95	2SK134	5.50	4.95
PN2222A	.10	.08	PN2907A	.10	.08
PN3463	.15		PN3565	.12	.11
PN3566	.15		PN3567	.10	.08
PN3569	.18	.16	PN3639	.18	.16
PN3640	.18	.16	PN3641	.10	.08
PN3642	.10	.08	PN3643	.10	.08
PN3644	.15	.13	PN3645	.15	.13
PN4250A	.15		PN4355	.16	.14
PN4356	.16		MPSA42	.23	.20
MPSA43	.23		MPSA55	.15	.14
MPSA56	.15	.14	MPSA92	.22	.20
MPSA93	.22	.20	SC1410	.85	.75
BU126	1.50	1.25	BUX80	2.75	2.55
BU208	2.50	2.20	2SD350	2.75	2.40
BU326	1.75	1.60	BC547	.07	.06
BC548	.07	.06	BC549	.07	.06
BC557	.07	.06	BC558	.07	.06
BC559	.07	.06			
Plus 30% tax where applicable					

POLYESTER 100V

"0	REEN	CAF	" T	PE
	Description		100+	1000+
R15131 .	001uF	0.06	0.04	.03
R15137 .	0012uF	0.06	0.04	.03
R15138 .	0015uF	0.06	0.04	.03
R15140 .		0.06	0.04	.03
R15142 .		0.06	0.04	.03
R15143.		0.06	0.04	.03
R15145 .		0.06	0.04	.03
R15146 .		0.06	0.04	.03
R15147 .		0.06	0.04	.03
R15148 .		0.07	0.05	.04
R15150 .		0.07	0.05	.04
R15152 .		0.07	0.05	.04
R15154 .0		0.07	0.05	.04
R15155 .		0.07	0.05	.04
R15156 .		0.08	0.06	.05
R15157 .		0.08	0.06	.05
R15158 .0		0.08	0.06	.05
R15159 .0		0.08	0.07	.05
R15160 .:		0.09	0.08	.07
R15162 .		0.11	0.10	.09
R15164 .2		0.15	0.14	.13
R15165 .2		0.16	0.15	.14
R15172.1		0.70	0.55	0.50
R15176 2		1.20	1.10	1.00
R15178 3		1.50	1.20	

SUPER DISCOUNT 51/4" FLOPPY DISKS

Attention schools, clubs, software houses etc! These are 100% certified, prime spec. D/S D/D disks with a 5 year warranty and made by a leading manufacturer, only without labels or brand names! But have a look at the price! Sensational value to say the least!

Descript 10+ 100+ 1,000+10,000-D/S D/D \$1.20 \$1.10 \$0.90 \$0.80 Plus 20% tax where applicable FREE sample disk available on request (Please send \$2 to cover postage)



VERBATIM DATA LIFE

DISKETTES

Cat. No. 1-9box 100+box 500+box 51/4*SS/DD 25.00 23.50 22.50 51/4*"DS/DD 32.00 27.50 25.00 XIDEX DISKETTES 5¹/₄"SS/DD 25.00 25.00 5¹/₄"DS/DD 34.00 30.50 3¹/₂"SS/DD 59.00 47.50 3¹/₄"DS/DD 69.00 55.50 22.50 28.50 45.00 50.00



PANEL METERS

Cat No. Descript.

1-9
010500 MU45 0-1mA
7.50
6.35
010502 MU45 0-50uA
7.50
6.35
010505 MU45 0-50uA
7.50
6.35
010505 MU45 0-50uA
7.50
6.35
010505 MU45 0-50uA
7.50
6.35
010510 MU45 0-50u
7.50
6.35
010510 MU45 0-50u
7.50
6.35
010520 MU45 0-20
7.50
6.35
010523 MU45 0-100
7.50
010530 MU55 0-100
7.50
010530 MU55 0-100
7.50
010530 MU55 0-100
7.50
010550 MU55 0-100
7.50
01050 MU55 0-100



500K DISK DRIVE FOR IBM

12 months warranty! 10+ \$135 Plus 20% tax where applicable (*IBM is a registered trademark)

DISK DRIVE FOR APPLE*

(6502 SYSTEM)
10-24
\$165
Plus 20% tax where applicable
('Apple is a registered tradema





NICADS

1-99 100+ 250+ \$2.00 \$1.90 \$1.70 \$5.55 \$5.45 \$5.15 \$5.75 \$5.50 \$5.25

Cat.No. Descript. 1-9 T12461 240V 4 1/2" 11.00 T12465 240V 3 1/2" 11.00 T12463 115V 4 1/2" 11.00 T12467 115V 3 1/2" 11.00

APRIL CROSSWORD

1. Device triggered by microwaves. (5,8)

8. Phenomenon affecting radio reception. (7)

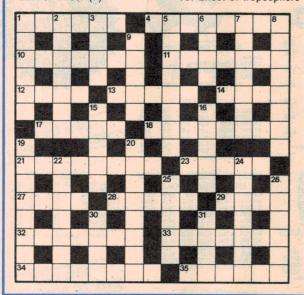
10. Said of a number with a radix of three. (7)

11. Useful place for a magnetic plug. (4)

12. Type of wing used on F/A18. (5)

13. Applied to a pinball machine. (4)

16. Effect of troposphere on



radio beams. (7)

17. Type of diode. (6)

20. Symbol used for wavelength. (6)

22. Accurate measuring instrument. (7)

26. Hyperbolic function. (4)

27. What EFTS can do to your account. (5)

28. Sixth letter of Greek alphabet. (4)

31. Part of automotive traffic indicator circuit. (7)

32. Type of potentiometer. (7)

33. Male-to-female D-type adaptor. (6,7)

DOWN

1. Substance used to prevent etching in PCB manfacture. (6)

2. Said of a non-static characteristic. (7)

3. Twisted cable of natural fibres. (4)

4. Elevate retracted antenna. (6)

5. Doughnut-shaped rings. (4)

6. Adjust relative position. (7)

SOLUTION FOR MARCH



9. Inventor of the maser, and proponent of the laser. (6)

14. Etude. (5)

15. Possible results of severe electric shock. (5)

18. Electronic device with unknown contents. (5,3)

19. Sequential connection of components. (6)

21. Pattern substrate etching. (7)

23. End of the day. (7)

24. Unit of phase difference. (6)

25. Possible indication of a siren. (6)

29. Conductors at high

frequencies exhibit a — effect. (4)

30. Type style for a printer. (4)



be considered.

AM broadcasters are also having to rethink certain practices which have grown up over the years. To achieve a subjectively louder signal, for example, peak limiting has been freely exploited and modulation "fiddled" to increase the amplitude of positive excursions without cutting the carrier on negative excursions. C-QUAM calls for substantially symmetrical modulation and a certain minimum limit to carrier amplitude.

Again, to ensure a brighter sound with indifferent, narrow-band receivers, the stations have commonly applied boost to audio frequencies in the upper middle register. As heard on wideband tuners, this can exaggerate sibilants in speech and impart an obvious "edginess" to music. The problem can be alleviated by use of treble cut in wideband receivers but AM stereo broadcasters will obviously need to agree on a uniform amount of pre-emphasis.

C-QUAM stereo tuner

Fig.8 illustrates the sequence of stages in a C-QUAM stereo tuner. The front end designated as "Tuner and IF Amp." is a superhet system as outlined in connection with Fig.5. However, an old-style superhet front-end with a manually tuneable oscillator is not desirable for a stereo AM tuner or receiver for a variety of reasons:

(a) It may be difficult to ensure that it is tuned to the exact centre of the channel, resulting in a non-symmetrical recovery of sidebands and degraded re-

sults.

(b) Even if correctly tuned initially, oldstyle tuners are subject to drift during operation, which may be sufficient to prejudice stereo reception.

(c) Conventional oscillators may also prove to be microphonic in a stereo tuner because any repetitive variation in frequency — therefore phase — can produce spurious audio output.

(d) Most existing tuners exhibit too narrow a bandwidth to permit the full

benefit of the stereo facility.

For these and other reasons, the idea of adding stereo to existing tuners, by way of a C-QUAM adaptor, is debatable. The best candidates for modification are undoubtedly good quality tuners with synthesiser front ends or logic controlled varactor tuning but, even with these, precautions may be necessary to limit hunting effects in the phase locked loop.

(For further information on this subject, see "Add-On Decoder for AM Stereo" in the October 1984 issue of

this magazine and recent correspondence in the Information pages).

With very few exceptions, new-generation C-QUAM tuners and receivers can be expected to incorporate modern crystal-locked synthesiser front ends and to include all necessary precautions against IPM effects from any source.

Pressing the appropriate station selector button brings up the precise local oscillator frequency, usually 450kHz above the wanted signal which as displayed on the digital readout. The 450kHz heterodyne resultant appears in the IF channel accurately and rigidly on frequency and ready for amplification and processing.

Setting up AM stereo

When the time comes to invest in a stereo AM/FM tuner, there is every reason to select a model which offers wide/normal bandwidth switching. While the actual bandwidth figures may vary somewhat from model to model, a new stereo tuner, when switched to narrow-band mono, should exhibit much the same gain and selectivity as an existing mono tuner or receiver.

This being the case, it should still be possible to listen to those weaker or more distant signals, if that desired. It may even be possible to tune some of them in stereo.

The real bonus, however, is the ability to hear the local AM stations in wideband stereo and this can be quite an experience the first time around, especially as heard through headphones. We have become so used to listening to cricket and other sport broadcasts in mono that it is quite startling to hear

the voice of a commentator against the stereo ambience of a large, vociferous crowd.

With music, of course, it's more a matter of AM radio catching up — almost — with everything else. For sure, the figures are not as good but, subjectively, the sound is way ahead of the "wireless" we've grown accustomed to.

In areas of high signal strength as, for example, Sydney's mid-western suburbs, clean stereo sound should be virtually routine. On the north, east and southern fringes, electrical noise could become a probelm, especially in homes where light dimmers have been fitted and where aluminium foil under the tiles tends to shut the interference in and keep the signals out!

If noise is noticeable on a mono tuner, it will increase by 3dB when switched to stereo, and by a few more dB in the wideband setting. This isn't a reason to abandon wide-range stereo, however; it should provide the incentive to take more care with the placement of the loop antenna provided, or to look into the possiblity of installing a large noise cancelling loop or a modest out-

door antenna.

And if a light dimmer is all that stands between you and good stereo AM, maybe it's time to disconnect it!

One final point: stereo AM can provide a very acceptable alternative for incar listening in those situations where stereo FM is being chopped up by multipath or the "picket fence" effect. AM signal quality varies in a much less disconcerting fashion and stereo should be all that it needs to make it competitive once again.

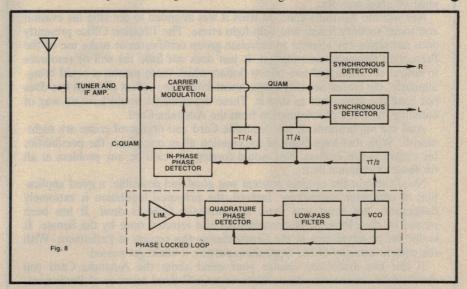


Fig.8: the main body of the tuner is contained in the box marked "Tuner and IF Amplifier". All the rest is concentrated, in practice, in a single dedicated IC and a modest handful of peripheral "bits".

Letters to the Editor ... ctd from page 5

by Department of Communications and Telecom staff. It is their professional expertise that helps to make Radio Australia the success it is.

N. Deer.

A/Controller Resources and Services, Radio Australia.

CD has earned its popularity

I was most interested in your "The about turntables" editorial (December 1986) and the predictable

reply from Thorens.

Before valid comparisons can be made, it is essential that the difficulties of optimising vinyl record playback systems as well as the cost of CD are considered.

Outside of a laboratory, it is virtually impossible to optimise a vinyl record playback system. The following factors must be considered:

(1). Matching stylus compliance with

tonearm mass.

- (2). Optimising, in four directions, the mounting of the cartridge in the arm.
- (3). Ensuring the arm is mounted correctly, in three directions, on the turnta-
- (4). Tuning the turntable suspension to the correct resonance.
- (5). Levelling of the turntable.
- (6). Matching the capacitance and impedance of the preamplifier input to the requirements of the cartridge.

To anyone who has tried to do the above with any degree of accuracy, the task is well nigh impossible. In addition, the phono preamplifier is inevitably the Archilles heel of any preamplifier.

The CD overcomes all the above problems, including the phono input

The vinyl record protagonists invariably pit a \$5000 turntable against a \$500 CD player. They also choose from a very small range of specially selected records to do their demonstrations. Most of these records have been digitally recorded!

History has shown us that when any technological breakthrough occurs, the old system is relegated to the lower end of the market. This was so with the change from cylinders to discs, acoustic to electrical recording, shellac to vinyl, mono to stereo, analog to digital, and now vinyl to CD.

One only has to visit a major record store to see the range of CDs against the range of vinyl records, most of which are of the cheap "television spe-

cial" variety.

The reason the esoteric magazines rave on about exorbitantly priced cartridges, tonearms and turntables is that they have to. CD has simplified hifi to the point where its use can be understood by the layman, and it is philosophically impossible for the magazines to support mass produced products made by giant multinational companies.

No one would suggest that CD is perfect, but it solves so many problems that it certainly deserves its huge popu-

John D. Browne, Alfred Cove, WA.

Editorial Viewpoint ... ctd from page 5

ganisation that has considered the legislation has pronounced itself in favour of it. The organisations actively against the Australia Card legislation include: The Joint Parliamentary Committee, Law Council of Australia, The Confederation of Australian Industry, NSW Privacy Committee, Real Estate Institute of Australia, Federated Clerks' Union, NSW Council of Australian Small Business Association, Australian Associated Stock Exchanges, Victorian Teachers' Union, Victorian Chamber of Commerce, NSW Anti-Discrimination Board, International Commission of Jurists, Australian Catholic Welfare Commission, Administrative & Clerical Officers' Association and last, but probably the most relevant as far as I am concerned, The Australian Computer Society. If they don't like the security of the proposed system, there must be great concern.

Nor will the Australia Card do what it was intended to do: stop tax evasion and social security fraud, and help fight crime. The Taxation Office presently does not make any attempt to correlate group certificates or make use of the Prescribed Payments information. It just does not have the will or resources to collect the estimated two billion dollars which these measures could bring. Similarly, the Social Security Department knows the extent of fraud but does not have the manpower to stop it. These departments would have no way of

handling the flood of information from the Australia Card.

And the implications of the Australia Card and organised crime are nightmarish. With that huge bank of information all in one place, the possibilities for extortion are endless. Nor would forging the card be any problem at all for those of criminal bent.

No, I thought the original concept was good and desirable, a good application of computer technology. Instead, the proposed legislation is extremely dangerous. Nor must you think the Australia Card is dead. It has been passed by the House of Representatives and rejected once by the Senate. It is due for re-submission to the Senate during this session of Parliament. With the current disarray of the Opposition parties, it could get passed.

If this has made you change your mind about the Australia Card you should take immediate action. Write to your Federal member of Parliament. Say that you don't want a bar of it.

Leo Simpson

Those plastic credit cards

Mr Y.Z.'s letter on plastic credit cards (December 1986, page 19) reminds me of a story that I heard some years ago.

A man in Florida inserted his card into an automatic telling machine, which duly digested his card but refused to return it and also refused to give him any money. At this the man whipped out a gun and shot the machine. I have much sympathy as one who has been cheated countless times by automatic ticket machines (an article on what sort of kicks to give these machines would, I am sure be useful).

The court treated this case with great solemnity. After all, the automatic telling machine was worth \$75,000, whereas the value of the contents of a mere person, according to the latest estimate and allowing for inflation, is around \$3.50. Furthermore, the automatic telling machines have an even more valuable database to support.

Y.Z. is certainly justified in feeling uneasy in the light of these relative values. However, I am sure that the incident in Florida will imbue us all with a correct sense of priorities and with a

dutiful humility. M. Gamble,

South Yarra, Vic.



"MINIATURE SOLID **TANTALUM CAPACITORS**"

KEMET ULTRADIP II

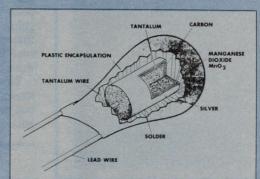
The new gold colour epoxy series with laser marking to MIL-1-46058. Conforms to Telecom spec.

CE-65050 (RJEP451 .../..)

This series has many features of the Kemet military approved types, but at prices allowing design into commercial-industrial equipment.

Available — exstock.

FREE SPECIFICATIONS AND DATA FROM:



CRUSADER ELECTRONIC COMPONENTS PTY. LTD.

81 PRINCES HWY, ST PETERS, NSW 2044 Phone 519 5030 516 3855 519 6685 Telex 23993 or 123993

APPOINTED DISTRIBUTORS:

APPOINTED DISTRIBUTORS:
SYDNEY GEORGE BROWN & CO PTY. LTD. PHONE 519 5855 GEOFF WOOD ELECTRONICS PTY. LTD. PHONE 810 6845
WOLLONGONG MACELEC PTY. LTD. PHONE 29 1455 CANBERRA GEORGE BROWN & CO PTY. LTD. PHONE 80 4355
NEWCASTLE NOVOCASTRIAN ELECTRONIC SUPPLIES PHONE 61 6055 MELBOURNE R.PG. AGENCIES PTY. LTD. PHONE
439 5834 JESEC COMPONENTS PTY. LTD. PHONE 598 2333 GEORGE BROWN & CO PTY. LTD. PHONE 419 3355 BRISBANE L. E.
BOUGHEN & CO PHONE 369 1277 COLOURVIEW WHOLESALE PTY. LTD. PHONE 275 3188 ST LUCIA ELECTRONICS PHONE
52 7466 ADELAIDE PROTRONICS PTY. LTD. PHONE 212 3111 D.C. ELECTRONICS PTY. LTD. PHONE 233 6946 PERTH SIMON
HOLMAN & CO PHONE 381 4155 PROTRONICS PTY. LTD. PHONE 362 1044

Do you want to... MAKE MORI MONEY2

of course, we all do ... then you need to work smarter not harder.

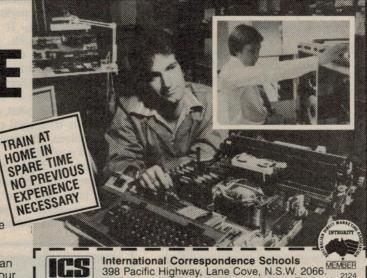
Specialised training will enable you to get a better job with more money so you can further enjoy your leisure time and do the things you want to do.

No need to take time from your family or hobbies! No need to change your way of life! Simply by spending an hour or so a day with an ICS course you can be on your way to a great new future.

Experts guide you every step of the way!

We show you what to do and how to do it — explain it all in easy-to-understand language — plus we provide all the necessary books, materials, tools and equipment, at no additional cost.

Don't let this opportunity pass you by!
Take a moment now to review the variety of courses available. The choice is yours - an opportunity to get the kind of training you need to further your career, expand on your hobby or start a whole new way of life. All you have to do is complete and mail the coupon, you are under no obligation, so what have you got to loose – absolutely nothing – so do it – TODAY!



398 Pa	ational Correspondence cific Highway, Lane Co ortenay Place, Wellingto	ve, N.S.W. 2066.
TICK ONE BOX ONLY Computer Programming	☐ Small Business Management ☐ Marketing Management	Carpentry & Joiners Commercial Art Dressmaking & Pa

	Computer	Management
1	Programming	Marketing Man
	Personal Computing	Public Relation
	Electronics Technician	Bookkeeping
	Fitness & Nutrition	Auto Mechanic
	Interior Design	Diesel Mechan
	Hotel/Motel	Motor Cycle
38	Management	Maintenance

Nutrition N	Auto Mechanics
esign	Diesel Mechanics
tel	Motor Cycle
nent	Maintenance

	Dressmaking &
3	Cutting
	Pharmacy Assi
	Secretarial Pra
	Refrigeration &
	Conditioning

9	Conditioning Practical Photography
-	Age

Mr/Mrs/Ms	Age		
Please print clearly) Address	at bioria direction of the state.		
	Plande		

Sydney: 427 2700 L FREE): (008) 22	(H

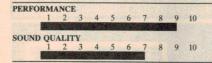
(Optional)

Compact Disc Reviews



MENDELSSOHN

Overtures and Symphony No. 3 The London Symphony Orchestra conducted by Claudio Abbado Deutsche Grammophon 415 973-2 DDD Playing time: 65 min 42 sec



Written when the composer was 17 years old the music to "A Midsummer Nights Dream" has a very pleasant, airy and youthful character to it, like many of his other compositions. It was intended as a concert overture and not for the theatre, yet 17 years later Mendelssohn added a set of incidental music for accompanying a play.

The 3rd symphony is very characteristic of Mendelssohn with its dance-like 2nd and 4th movements and a somewhat melancholic 1st movement. It was inspired by a trip to Scotland when the composer visited the ruins of "the place where Queen Mary lived and loved". This obviously conjured up ideas of sadness as evidenced in the "flavour" of the 1st and 3rd movements.

Overall the work is a real gem and I find it strange that it is not featured more often in concerts and on radio.

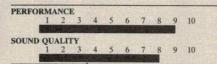
The overture "The Fair Melusina" is a rarely performed work but nevertheless very worthwhile. It was written as an example of how this work should be after hearing a composition of the same title by Conradin Kreutzer whom he disliked.

Whilst the music on this disc is excellent, the sound quality is a little disappointing. To some it may sound fatiguing but if you enjoy Mendelssohn, that will keep you listening. The string tone has a hardness about it and is almost overpowering.

This is disappointing for such great music. The playing time is very generous at nearly 66 minutes and there are good notes on all the works. (R.L.C.)

MENDELSSOHN

Violin Concerto, Octet OP.20 Pinchas Zukerman, soloist St. Paul Chamber Orchestra Philips 412 212-2 DDD Playing time: 61 min 59 sec



Maybe this is Mendelssohn month for here is a superb performance of his most famous work. It was first performed on March 13th, 1845 in Leipzig when the composer was 36 and just two years before his death.

The performance here, by Zukerman, is frankly flawless — superlatives are unnecessary. One point easily missed is that there is no formal conductor here, just the soloist directing, although no-one would ever know.

The octet in E flat is a well established work and explores some unusual musical form, yet is so appealing and friendly, especially the popular scherzo. Written when the composer was a mere



16 years old, I feel it is chamber music at its best and performed here extremely well.

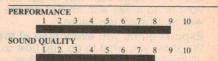
The sound quality just borders on excellent — maybe slightly dull but only slightly. Nothing appears to excel — probably the mark of a perfect balance yet somehow I think I may have heard better so I have given it a reluctant 8 where it may deserve a 9. Remember this is chamber music, not a rousing romantic symphony, so don't expect any sonic booms.

This music is more fully appreciated if you can get away from interruptions and listen with the lights out. Great stuff! (R.L.C.)



CHARLES DUTOIT

Scheherazade, Op.35
Capriccio Espagnol, Op.34
Richard Roberts, solo violin
Orchestre Symphonique de Montreal
conducted by Charles Dutoit.
Decca 410 253-2 DDD
Playing time: 61 min 11 sec



This work, I am sure most will agree, is a foot tapper if ever there was one. If you're not familiar with classical music but would like to be enlightened then here is a work that will get you going and give your hifi something to do.

It was written around the story of a thousand and one nights by a composer

so gifted in exploiting such a tale! The extremely rythmic tonal hues throughout this work I find most fascinating. There seems to be an endless melodic flow, almost to tease, as you are allowed just a little of each before an equally exciting new one emerges with its tantalising oriental rhythms.

As a bonus there is also the Spanish Caprice which is nearly as colourful as Scheherazade and also superbly played.

So you won't be disappointed with this disc. The playing is excellent, the tempos as they should be, and there is a good clean sound with accoustic ambience just right for a large orchestra. I would have preferred perhaps a little more body in the lower bass but I have to concede that this is a desirable version.

One point worth noting is the virtual lack of any program notes on these works or the composer. (R.L.C.)



the composer had recovered from a mental depression following the unjustifiably critical reception of his 1st symphony. Obviously, he must have recovered well, for the 2nd concerto is probably his most famous work and one that you never seem to tire of.

The recording I feel, is not up to the

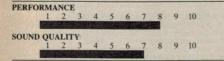
usual standard we have come to expect from Philips. Possibly it is an acoustic problem as there is a certain boomy quality to the upper bass although the overall balance is quite good with excellent sonic impact from the brass. This boomy quality seemed to be much less noticeable in the 2nd concerto than the 1st. In fact, the 2nd sounds excellent and on it's own would rate a 9 in this regard.

This seemed strange to me so I looked for a possible reason and found that there is a two year gap between the recordings as mentioned on the cover notes, which give excellent accounts of these concertos.

I would have preferred a little more feeling from the performer in the 1st movement of the 2nd work but this does not apply to the 2nd or 3rd movements which were magnificently played. (R.L.C.)

RACHMANINOFF

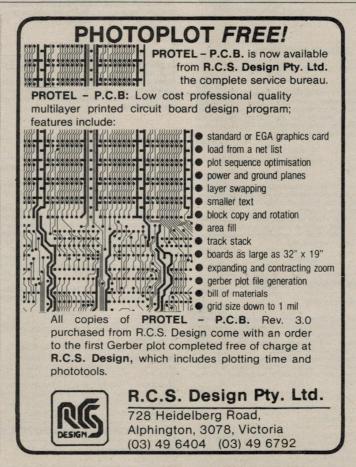
Piano Concertos 1 & 2
Zoltan Kocsis, piano
San Francisco Symphony conducted by
Edo de Waart
Philips 412 881-2 DDD
Playing time: 55 min, 44 sec



The 1st concerto here could be regarded as Rachmaninoff's debut as a composer. Commenced when he was 17, it is an interesting work but what we always hear is the revised version of some nine years later. It has a magnificent opening but I feel the 1st movement lacks something, particularly when compared with the magnificent No. 2 concerto.

However, this is merely a personal opinion and the playing of Zoltan Kocsis of this work is extremely good. Tempos are on the brisk side but I don't mind that at all. The 2nd movement is skillfully played and the last movement seems to benefit from the lively tempo.

The 2nd concerto was written after



DATA & REFERENCE

DIGITAL IC EQUIVALENTS AND PIN CONNECTIONS

A. Michaels BP0140
Shows equivalents and pin connections of a popular user-orientated selection of European, American and Japanese digital ICs. Also includes details of packaging, families, functions, manufacturer and country of origin

256 pages (Large Format)

LINEAR IC EQUIVALENTS AND PIN CONNECTIONS

A. Michaels
Shows equivalents and pin connections of a popular user-orient selection of European, American and Japanese linear ICs. includes details of functions, manufacturer, and country of or American and Japanese linear ICs. Also

320 pages (Large Format)

INTERNATIONAL TRANSISTOR EQUIVALENTS GUIDE

A. Michaels
Helps the reader to find possible substitutes for a popular userorientated selection of European, American and Japanese
transistors. Also shows material type, polarity, manufacturer and

320 pages

CHART OF RADIO, ELECTRONIC, SEMICONDUCTOR AND

M. H. Babani, B.Sc.(Eng)

Illustrates the common, and many of the not-so-common, radio, electronic, semiconductor and logic symbols that are used in books, magazines and instruction manuals, etc., in most countries throughout the world

Chart

RADIO AND ELECTRONIC COLOUR CODES AND DATA CHART B. B. Babani

Covers many colour codes in use throughout the world, for most radio and electronic components. Includes resistors, capacitors, transformers, field coils, fuses, battery leads, speakers, etc.

Chart

AUDIO AND HI-FI

BUILD YOUR OWN SOLID STATE HI-FI AND AUDIO

BUILD YOUR OWN SOLID STATE HI-FI AND AUDIO ACCESSORIES

M. H. Babani
An essential addition to the library of any keen hi-fi and audio enthusiast. The design and construction of many useful projects are covered including: stereo decoder, three-channel stereo mixer, FET pre-amplifier for ceramic PUs, microphone pre-amp with adjustable bass response, stereo dynamic noise filter, loud-speaker protector, voice-operated relay, etc.

\$6.00 \$6.00

96 pages

AUDIO PROJECTS

F. G. Rayer

BP0090
This book covers in detail the construction of a wide range of audio projects. The text has been divided into the following main sections: Pre-amplifiers and Mixers, Power Amplifiers, Tone Controls and Matching, Miscellaneous Projects.

All the projects are fairly simple to build and have been designed around inexpensive and readily available components. Also, to assist the newcomer to the hobby, the author has included a number of board layouts and wiring diagrams. \$8.50

COMPONENT SPECIFIC

MODERN OP-AMP PROJECTS

R. A. Penfold
Includes a wide range of constructional projects which make use of the specialised operational amplifiers that are available today, including low noise, low distortion, ultra-high imput impedance, low slew rate and high output current types. Circuits using transconductance types are also included.

All of the projects are fairly easy to construct and a stripboard layout is provided for most of them so that even constructors of limited experience should be able to build any of the projects with the minimum of difficulty.

112 pages

\$8.50

MODEL RAILWAY PROJECTS

R. A. Penfold
The aim of this book is to provide a number of useful but reasonably

simple projects for the model railway enthusiast to build, based on inexpensive and easily obtainable components. The projects covered include such things as controllers, signal and sound effects units, and to help simplify construction, stripboard layouts are provided for each project.

112 pages

AERIALS

AERIAL PROJECTS
R. A. Penfold
The subject of aerials is vast but in this book the author has considered practical aerial designs, including active, loop and ferrite aerials which give good performances and are relativley simple and inexpensive to build. The complex theory and mathematics of aerial designs have been suited.

design have been avoided.

Also included are constructional details of a number of aerial accessories including a pre-selector, attenuator, filters and tuning

96 pages

25 SIMPLE AMATEUR BAND AFRIALS

This concise book describes how to build 25 amateur band aerials that are simple and inexpensive to construct and perform well. The designs start with the simple dipole and proceed to beam, triangle and even a mini-rhombic made from four TV masts and about 400 You will find a complete set of dimension tables that will help you

spot an aerial on a particular frequency. Dimensions are given for various style aerials and other data needed for spacing and cutting phasing lengths. Also included are dimensions for the new WARC bands

80 pages

25 SIMPLE SHORTWAVE BROADCAST BAND AERIALS Fortunately good aerials can be erected at low cost, and for a small

Fortunately good aerials can be erected at low cost, and for a small fractional part of the cost of your receiving equipment.

This book tells the story. A series of 25 aerials of many different types are covered, ranging from a simple dipole through helical designs to a multi-band umbrella.

25 SIMPLE INDOOR AND WINDOW AERIALS

BP0136

Written for those people who live in flats or have no gardens or other space-limiting restrictions which prevent them from constructing a

conventional aerial system.

The 25 aerials included in this book have been especially designed, built and tested by Mr. Noll to be sure performers and give surprisingly good results considering their limited

64 pages

included as well.

25 SIMPLE TROPICAL AND MW BAND AERIALS E. M. NoII E. M. Noil

BP0145

Shows you how to build 25 simple and inexpensive aerials for operation on the medium wave broadcast band and on 80, 75, 90 and 120 metre tropical bands. Designs for the 49 metre band are

64 pages

\$6.00

FAULT-FINDING

HOW TO GET YOUR ELECTRONIC PROJECTS WORKING R. A. Penfold BP0110 The aim of this book is to help the reader overcome problems by

The aim of this book is to help the reader overcome problems by indicating how and where to start looking for many of the common faults that can occur when building up projects.

Chapter 1 deals with mechanical faults such as tracing dry joints, short-circuits, broken P.C.B. tracks, etc. The construction and use of a tristate continuity tester, to help in the above, is also covered. Chapter 2 deals with linear analogue circuits and also covers the use and construction of a signal injector/tracer which can be used to locate and isolate the faulty areas in a project. Chapter 3 considers ways of testing the more common components such as resistors, capacitors, op amps, diodes, transistors, SCRs, unijunctions, etc., with the aid of only a limited amount of test equipment.

equipment

equipment.

Chapter 4 deals with both TTL and CMOS logic circuits and includes the use and construction of a pulse generator to help fault-finding.

\$8.50

96 pages

TRANSISTOR RADIO FAULT-FINDING CHART BP070 C. E. Miller

Used properly, it should enable the reader to trace most common faults reasonably quickly. Across the top of the chart will be found four rectangles containing brief descriptions of these faults, vis - sound weak but undistorted, set dead, sound low or distorted and background noises. One then selects the most appropriate of these and following the arrows, carries out the suggested checks in sequence until Chart

ELECTRONIC & COMPUTER MUSIC

ELECTRONIC MUSIC PROJECTS

PR. A. Pentoid

Provides the constructor with a number of practical circuits for the less complex items of electronic music equipment, including such things as fuzz box, waa-waa pedal, sustain unit, reverberation and phaser units, tremelo geneator, etc.

The text is divided into four chapters as follows:

Chapter 1, Guitar Effects Units; Chapter 2, General Endoc Chapter 3, Sound General Projects; Chapter 4, Accessories. \$9.50

112 pages

ELECTRONIC SYNTHESISER CONSTRUCTION R. A. Penfold

R. A. Penfold

Should enable a relative beginner to build, with the minimum of difficulty and at reasonably low cost a worthwhile monophonic synthesiser, and also learn a great deal about electronic music synthesis in the process. This is achieved by considering and building the various individual parts of the circuit that comprise the whole instrument as separate units, which can then be combined together to form the final synthesiser. Printed circuit designs are provided for these main modules. Later chapters deal with sequencing and some effects units.

112 pages

\$11.00

MIDI PROJECTS

MIDI PROJECTS

R. A. Penfold

Provides practical details of how to interface many popular home computers with MIDI systems. Also covers interfacing MIDI equipment to analogue and percussion synthesisers.

112 pages

MORE ADVANCED ELECTRONIC MUSIC PROJECTS

R. A. Penfold
Intended to complement the first book (BP74) by carrying on where it left off and providing a range of slightly more advanced and complex projects. Included are popular effects units such as flanger, phaser, mini-chorus and ring-modulator units. Some useful percussion synthesisers are also described and together these provide a comprehensive range of effects including drum, cymbal and prophyloge sounds. and gong-type sounds.

96 pages

COMPUTER MUSIC PROJECTS

R. A. Penfold

BP0173

R. A. Penfold Shows some of the ways a home computer can be used to good effect in the production of electronic music. Topics covered include sequencing and control via analogue and MIDI Interfaces, computers as digital delay lines and sound generators for computer

112 pages

\$11.00

MISCELLANEOUS

COIL DESIGN AND CONSTRUCTION MANUAL

BP0160
B. B. Babani
B. R. Sabani
BP0160
A complete book for the home constructor on "how to make" RF, IF, audio and power coils, chokes and transformers. Practically every possible type is discussed and calculations necessary are given and explained in detail. All mathematical data is simplified for use by everyone

96 pages

AN INTRODUCTION TO Z80 MACHINE CODE

AN INTRODUCTION TO Z80 MACHINE CODE

R. A. & J. W. Penfold

Takes the reader through the basics of microprocessors and machine code programming with no previous knowledge of these being assumed. The microprocessor dealt with is the Z80 which is used in many popular home computers and simple programming examples are given for Z80-based machines including the Sinclair ZX-81 and Spectrum, Memotech and the Amstrad CPC 464. Also applicable to the Amstrad CPC 664 and 6128.

\$10.00

144 pages

A Z-80 WORKSHOP MANUAL

BP0112 This book is intended for people who wish to progress beyond the stage of BASIC programming to topics such as machine code and

assembly language programming, or need hardware details of a Z-80 based computer.

\$12.00

GETTING THE MOST FROM YOUR PRINTER

J. W. Penfold BP0181
Details how to use all the features provided on most dot-matrix printers from programs and popular word processor packages like Wordwise, Visawrite and Quill, etc. Shows exactly what must be typed in to achieve a given effect.

192 pages

96 pages

\$11.00

CIRCUITS & CONSTRUCTIONAL PROJECTS

BEGINNERS GUIDE TO BUILDING ELECTRONIC PROJECTS

BP0227

Shows the complete beginner how to tackle the practical side of electronics, so that he or she can confidently build the electronic projects that are regularly featured in the popular magazines and books. Also includes examples in the form of simple projects that you can build

112 pages

Babani Book

50 PROJECTS USING RELAYS, SCRs AND TRIACS

50 PhoteCt's using RELAT'S, sons that it makes

BP0037

This book gives tried and practical working circuits which should present the minimum of difficulty for the enthusiast to construct. In most of the circuits there is a wide latitude in component values and types, allowing easy modification of circuits or ready adaption of them to individual needs.

112 pages

POPULAR ELECTRONIC PROJECTS

Provides a collection of the most popular types of circuits and projects covering a very wide range of interests, including Radio, Audio, Household and Test Equipment projects.

144 pages

ELECTRONIC TEST EQUIPMENT CONSTRUCTION

F. G. Rayer

This book covers in detail, the construction of a wide range of test
equipment for both the electronics hobbyist and radio amateur. Included
are projects ranging from a FET amplified voltmeter and resistance bridge
to a field-strength indicator and heterodyne frequency meter.
Not only can the home constructor enjoy building the equipment but the
finished product can also be usefully utilised in the furtherance of his hobby.
88.00

HOW TO USE OP-AMPS

E. A. Parr

This book has been written as a designer's guide covering many operational amplifiers, serving both as a source book of circuits and a reference book for design calculations. The approach has been made as non-mathematical as possible and it is hoped, easily understandable by most readers, be they engineers or hobbyists.

\$11.00

BP088

BP0176

\$11 00

160 pages

ELECTRONIC GAMES

Contains a number of interesting electronic games projects using modern integrated circuits. The text is divided into two sections, the first dealing with simple games and the latter dealing with more complex circuits thus making the book ideal for both beginner and more advanced enthusiast alike.

96 pages

NEW RELEASES!

A TV-DXERS HANDBOOK

R. Bunney

Completely revised and updated by Roger Bunney who is probably one of the leading authorities in this country on the subject. Includes many units and devices which have been designed and used by active enthusiasts, and often, considerable ingenuity and thought have gone into the development of such units to overcome individual problems.

A practical and authoritative reference to this unusual

aspect of electronics. (Large Format)

AN INTRODUCTION TO CP/M

R. A. Penfold

CP/M is more than just a program to give a common set of standards and hence software compatibility between various computers. It includes a range of commands that help with such things as file copying and editing, the directing of data to the appropriate device etc. In order to get the best from CP/M and the programs running under it, a basic understanding of the system is highly desirable, and this book tells the story. 96 pages

ELECTRONIC CIRCUITS FOR THE COMPUTER CONTROL OF ROBOTS BP0179

R. A. Penfold

Provides information and circuits on computer control of electric motors (including stepper types), plus a range of useful sensors including visible light, infra-red, and ultrasonic 96 pages \$11.00

USING YOUR AMSTRAD CPC DISC DRIVES BP0189 J. W. Penfold

Covers such things as tracks, sectors and formatting; AMDOS and CP/M operating systems including rules and regulations, filing from BASIC, file copying and transfer; program development including MERGE and CHAIN MERGE: CP/M turnkey discs etc.

96 pages

IC 555 PROJECTS

E. A. Perr

Every so often a device appears that is so usefull that one wonders how life went on before without it. The 555 timer is such a device, included in this book are basic and general circuits, motorcar and model railway circulas, alarms and noise-makers as well as a section on the 556, 558 and 559 timers.

\$9.50

176 pages (Available February 1987)

HOW TO DESIGN AND MAKE YOUR OWN P.C.B.s

R. A. Penfold

Chapter 1 deals with the simple methods of copying printed circuit board designs from magazines and books and covers all aspects of simple P.C.B. construction as comprehensively as possible. Chapter 2 covers photographic methods of producing p.c.b.s and Chapter 3 deals with most aspects of designing your own printed circuit board layouts.

80 pages

POWER SUPPLY PROJECTS

POWER SUPPLY PROJECTS

R. A. Penfold

The purpose of this book is to give a number of power supply designs, including simple unstabilised types, fixed-voltage regulated types, and variable-voltage stabilised designs, the latter being primarily intended for use as bench supplies for the electronics workshop. The designs provided are all low-voltage types for semi-conductor circuits. This book should also help the reader to design his own power supplies.

\$7.50

96 pages

HOW TO DESIGN ELECTRONIC PROJECTS R. A. Penfold

BP0127

H. A. Péritora.
The aim of this book is to help the reader to put together projects from standard circuit blocks with a minimum of triel and error, but without recording to any advanced methoratics. Firsts on designing circuit blocks to meet your special requirements where no "stock" design is available are also provided.

128 pages

ELECTRONIC SECURITY DEVICES

ELECTRONIC SECURITY DEVICES

R. A. Penfold

Many people associate the term "security device" with only burglar alarms of various types, but in fact, any piece of equipment which helps to protect people and property against any form of danger could be termed a "security device".

Therefore this book, besides including both simple and more sophisticated burglar alarm circuits using light, infra-red and ultrasonics, also includes many other types of circuits as well, such as gas and smoke detectors, flood alarms, doorphone and baby alarms, etc.

FURTHER PRACTICAL ELECTRONICS CALCULATIONS AND FORMULAE

F. A. Wilson

Written in the same style as the first book (BP53) and with the same objectives in mind, this book is divided into the COMMUNICATION

(Elements of Electronics — Book 5)

F. A. Wilson

A look at the electronic fundamentals over the whole of the

A look at the electronic fundamentals over the whole of the communication scene. This book aims to teach the important elements of each branch of the subject. Most of the modern transmissions system techniques are examined including line, microwave, submarine, satilite and digital multiplex systems, radio and telegraphy. To assist in understanding these more thoroughly, chapters on signal processing, the electromagnetic wave, networks and transmission assessment are included, finally a short chapter on optical transmission.

256 pages

50 SIMPLE LED

R. N. Soar

Contains 50 interesting and useful circuits and applications, covering Contains 50 interesting and useful circuits and applications, covering many different branches of electronics, using one of the most inexpensive and freely available components — the light-emmitting diode (LED). Also includes circuits for the 707 common anode display.

\$6.00

BP0042

BP0097

\$8.50

64 pages

IC PROJECTS FOR

BEGINNERS F. G. Rayer

Offers a range of simple projects based around a number of popular and inexpensive linear and digital integrated circuits. With most projects, complete layout and/or point-to-podiagrams are included to help simplify construction.

112 pages

\$8.50

ELECTRONIC PROJECTS

USING SOLAR CELLS

O. Bishop

This is a book of simple circuits which have applications in and around the home and that are designed to be powered by the energy of the sun. Although, if the reader wishes, they could alternatively be powered by the ordinary button cells

or small dry batteries

following fourteen sections: Electricity, Electrostatics, Electromagnetism, Complex numbers, Amplifiers, Signal Generation and Processing, Communication, Statistics, Reliability, Audio, Radio, Transmission Lines, Digital Logic and Power Supplies 512 pages

128 pages

BP0144

(If insufficient space enclose separate list) DOOK TITLE

For airmail outside Australia add \$5.00 to these charges.

BOOK IIILE	BOOK NOMBER	QIY	PRICE
	With the state of		
20 TO 10	School of the second		
		ACTION AND ADDRESS OF THE PARTY.	NAME OF TAXABLE PARTY.

Send to: Freepost No.4

PO BOX 227

Total Price of Books\$

Plus post & handlings (flat rate up to 10 books)

TOTALS

Date:

Waterloo 2017 (no stamp required)

Federal Publishing

Name: Telephone:

Address: Postcode:

Please tick box to indicate method of payment: Cheque* / Money Order *Please make payable to the Federal Publishing Company Pty. Ltd.

Mastercard □ American Express □ Bankcard □ Visa □ Credit Card No:

Signature Expiry Date (Unsigned orders cannot be accepted. As these books are imported, unavoidable delays may occur.

EA APR' 87



nformation centre

Parts for Playmaster 60/60 amplifier

I am writing in regards to the Playmaster 60/60 amplifier. While reading your article I thought it would be a good kit to build as it seems to be an

excellent amplifier.

However, a friend of mine enquired at one of Melbourne's smaller kitset suppliers and was turned away by one of the sales representatives because of things like the printed circuit board is apparently 3mm too big for the cabinet to go over it and also some problem about the toroidal transformer. I would like your views on this. (R.G., West Footscray, Vic).

• Complete kits of parts for this amplifier are available from at least two sources: (1) Jaycar in Sydney and (2) Altronics Pty Ltd in Perth. We also understand that Dick Smith Electronics is currently in the process of kitting up for this project.

The kitset supplier in question, who is not an advertiser in this magazine, has not made the effort necessary to be able to supply the kit. Hence, they have

poured cold water on it.

It is utterly ridiculous for them to suggest that the PCB is too big to go into the cabinet. The board was specially designed to fit into a standard rack mounting cabinet and the photographs published with the articles should prove that there are no problems in this regard.

It is true that the toroidal transformer has been in short supply but an approved locally-made substitute transformer which works just as well is now available and is presently being supplied

by Jaycar Electronics.

Modifying a Pioneer tuner for AM stereo

I incorporated the AM stereo decoder published in the October 1984 issue of EA in a six year old Pioneer TX-5300 tuner, and encountered and resolved the following problems:

(1) The decoder would not remain locked to the 25Hz sub-carrier on all stations. The stereo indicator LED (which lights when the decoder is locked) would reliably light on only two of the four local stations. Lock was difficult to achieve with 6IX and 6KY and would drop-out after a few minutes operation. I am told that both these stations use the same encoding equipment.

A check on pin 14 of the MC13020 showed that the recovered 25Hz subcarrier voltage was less than half (about 300mV p-p) that of the stations which produced reliable lock. This voltage is proportional to the modulation depth of the 25Hz subcarrier as the RF carrier is subject to AGC. Thus, if the Motorola circuit was thoroughly tested (and it's odds on that it was), then I suspect that at least two of the stations are transmitting less than the recommended 4% subcarrier.

The solution is to increase the recovered level of the subcarrier by: (a) removing the $7.5k\Omega$ resistor on pin

(b) short the 430Ω resistor on pin 11. (c) reduce the $4.7\mu F$ capacitor on pin

11 to $1\mu F$.

The $7.5k\Omega$ resistor is an attenuator, whilst the other two components form a low-pass filter, which has its cutoff frequency raised by the above modifications. The following active bandpass filter provides adequate filtering. The result is a doubling of the recovered 25Hz subcarrier signal at pin 14. Greater than 500mV p-p provides reliable lock, and 400mV p-p minimum was required.

(2) Tantalum capacitors must be used in lieu of electrolytic capacitors on pins 11, 12, 13 and 14 as the capacitance spread (tolerance) of electrolytic capacitors is

too large.

(3) The three oscillator capacitors on pins 17 and 18 must be low temperature coefficient NPO types (I used Philips miniature square ceramic plate types) to prevent the VCO from drifting off frequency. The disc ceramic types provided in my kit were useless for this application. This modification allows stable locking from cold to normal temperatures.

The above modifications are considered essential and the following are specific to the tuner mentioned:

(4) The local oscillator/IF/detector stage (HA1138 IC) power rail was regulated by the addition of a 9V 400mW zener diode between pin 12 and ground (pin 16). This reduces distortion due to phase modulation of the IF signal caused by large changes in signal level modulating the Vcc rail. An existing 47Ω resistor (R23) between pin 12 and Vcc limits the current, and forms part of an RC decoupling network.

(5) The IF feed is from pin 13 of the HA1138 IC, via an added 500kΩ trimpot used as a variable resistor, and adjusted for 500mV p-p into the decoder. A x10 probe should be used to minimise loading effects while measuring this sig-

(6) The $2.2k\Omega$ resistor on pin 10 (R26) was removed to disable the mono AM output, and the selector switch rewired to provide stereo AM switching to the

output.

(7) The tuner bandwidth is set by a ceramic resonator to about 4.5kHz and limits the tuner performance in the AM mode. This can be improved marginally by loading the primary winding of the transformer feeding the resonator with a $10k\Omega$ resistor, and slightly detuning (stagger tuning) the transformer, at the expense of reducing selectivity and sensitivity.

The overall result of these modifications is a stable, reliable tuner with reasonable performance, limited by bandwidth, which is better than mono AM but not as good as stereo FM. I cannot detect any change in the distortion level between AM mono and stereo with

Twenty years ago, I wrote to your magazine and asked you how to dim interior lights in an FB Holden with a resistor, which you kindly explained. I have written the above in a expanatory style for use as you wish. It is my pleasure to return the favour. (A.L. Darlington, WA)

 Thanks for taking the trouble to write and return the favour.

Can't calibrate capacitance meter

I recently completed the Digital Capacitance Meter (described August 1985) and found that I was unable to carry out the calibration procedure until I had changed trimpot VR3 to $2k\Omega$ and the associated $2.2k\Omega$ resistor to $1k\Omega$.

I allowed one hour before completing calibration so that the instrument might reach a steady temperature. Before using it for making any measurement I leave it switched on for at least an hour.

The problem is that when I use the original calibration capacitors I find that the readings vary by one or two units; ie, the $47\mu\text{F}$ may read between $45\mu\text{F}$ and $49\mu\text{F}$. This occurs over the three ranges. The further the capacitor is from any of the three calibration values the greater the problem becomes. The variation in this case might be 15 or more units and I have yet to see the reading stabilise as even at its steadiest, it still varies over two or three units.

I believe the instrument is capable of better performance than I have experienced and any advice you can give will be greatly appreciated. (D.P., Tamworth, NSW).

• Because you have found it necessary to change some of the resistor values around the reference oscillator, we suspect that you are not using a 74C14 or 40106 Schmitt trigger IC as specified in the parts list.

In fact, we have become aware of at least one retailer who has been substituting an MC14585 Schmitt trigger for IC1. Please note that this IC is quite unsuitable as its hysteresis levels are quite different to those of the ICs specified.

The answer to bad cases of display jitter is to use a separate IC for Schmitt trigger oscillator IC1c. This is done by mounting a second 74C14 or 40106 on top of the existing IC in piggyback fashion, and soldering their supply leads

(pins 14 and 7) together. It's then simply a matter of running connections for the gating oscillator directly to the pins of the piggyback IC.

Polyswitch protectors for loudspeakers

I refer to the article by Leo Simpson on "Foolproof Loudspeaker Protection" in your July 1986 issue where particular reference was made to polyswitch protectors

I have a Sansui R-30 receiver purchased around 1978 (minimum 25W RMS per channel into 8Ω) playing into two Wharfedale Super 10RS/DD loudspeakers dating from around 1967 (actual resistance 10Ω , maximum input 10W RMS). I realise that these loudspeakers represent outmoded technology but they are more than OK for my needs. They replaced the original pair of similar loudspeakers I purchased in 1965, one of which blew last June when the receiver developed a fault which apparently resulted in a relatively large DC voltage at the output.

There are no built-in speaker protection devices in the receiver but I have since installed 250mA fuses in the positive leads to the loudspeakers at the amplifier end.

For various reasons I took six months to get the receiver repaired satisfactorily and I now want to ensure, if feasible, that the speakers won't be similarly damaged in the event of a further amplifier fault. I understand fuses aren't very reliable and I regard them only as an interim measure.

When I enquired at Jaycar Electronics about the polyswitch devices in your

article I was told they would not be appropriate because of the low power ratings of the equipment involved. However, I noticed that in your article on page 61 under "other applications" it mentioned that such devices are available in a large range of ratings. Could you therefore please advise whether there is a polyswitch protector available to protect my loudspeakers and where I might be able to get them. (H.D.W. Kenmore, Old).

• Although units in other ranges are manufactured, they are unavailable in small off quantities. Unfortunately though, the people at Jaycar are wrong. As we explained in our July 1986 article, the RDE 115A is suitable for systems up to 100 watts. Therefore, the RN3415, now sold by Jaycar, would be quite suitable for protecting your loudspeakers.

Alternatively, you could incorporate relay protection for your loudspeakers. A suitable loudspeaker protector was described in the November 1975 issue of EA (File No 1/MS/13) and could be built into your Sansui receiver. Photostat copies of this article are available from our Information Service at \$4, including postage.

Solar powered motor boat

In your November 1986 issue an article appeared concerning a solar powered bilge pump for a boat. Although a solar powered small craft has already crossed the Atlantic Ocean between the UK and the USA I am intrigued by the solar powering possibilities for a small craft which would need:

TOYO VIDEO PRINTERS TP-45, TP-95, TP-115



A range of handy, compact thermal printers that lets you record directly from a CRT screen.

- * High resolution: 11.8 dots/mm (TP-115), 6 dots/mm (TP45, TP95)
- * High speed printing: 15.3 seconds per screen (TP,45)
- * Switchable negative or positive prints
- * No "warm up" period required.

Applications

News Agencies, medical institutions, TV studios, CAD users, University & Research Organisations

A DIVISION OF TLE ELECTRICAL PTY LIMITED
(Incorporated in New South Wales)

36 LISBON STREET FAIRFIELD, N.S.W. 2165. AUSTRALIA TELEPHONE: (02) 728 2121, 727 5444 TELEX: AA27922 ATTN AMTEX FACSIMILE: (02) 728 6908, 728 2837.

Information Centre . . . ctd ///////

(1) A suitable number of high power solar panels for battery charging or direct motor drive.

(2) Say four 12V 6-cell lead-acid heavyduty automotive batteries.

(3) A suitable electric motor able to produce up to 0.25-0.33BHP.

(4) Simple reduction gearing to provide one BHP at the propellor with a propellar speed of 300-600rpm (not too low with suitable pitch).

(5) With such a set up a maximum boat speed of between four and six mph should be possible in a suitable hull of half tonne displacement.

I am not conversant enough with either electronics or electrics to go into further detail, but would be interested to read other reader's comments or concept. (D.C., Auckland, NZ)

• Your idea is interesting but appears to have a number of drawbacks. First, you only obtain maximum output from the cells in bright sunlight and with the cells oriented for maximum illumination. On a boat, these conditions would be seldom attained.

Second, you would need large battery storage if you needed to keep going at night and this would necessarily increase the hull weight considerably. Third, the use of reduction gearing from a third horsepower motor will not yield one horsepower. Under ideal conditions it will yield around 90% of the motor's rating. With these things in mind, you might be wise to take along a few sails.

Lack of bass in Playmaster amplifier

I have recently constructed the Playmaster 60-60 amplifier and also the Vifa 60-60 kit speakers.

In the time between completion of the speakers prior to building the amplifier, I used a low-cost low power (15W per channel) amplifier of some vintage to tide me over, and was quite impressed with the results, having not owned a pair of high quality speakers before.

After building the 60-60, I was very impressed with the clarity and purity of the sound, but a little disappointed with what seems to be a reduction in bass response, particularly at low output levels. The cheap amplifier seems a long way in front in this sense.

Is there a problem with my particular

unit, or could a modification to the tone control circuitry be worthwhile? The bass control knob is always fully clockwise and I would be interested in your comments. (R.S., Stawell, Vic.)

• First of all, we would like to assure you that when it is working correctly, there is nothing wrong with the bass response of the Playmaster 60-60. If your particular amplifier lacks bass response, the most probable cause is a faulty or incorrect value component.

To troubleshoot the problem, try rotating the bass control backwards and forwards. If there is a marked variation in the bass level, then the amplifier is probably perfectly OK. It could be that your low-cost amplifier lacks high-frequency response or has an inbuilt bass boost circuit, thus giving the impression of better bass.

If this is the case, the Playmaster amplifier will eventually sound much more natural after further listening.

You haven't told us whether the problem occurs on all inputs or only on the Phono input. If the problem only occurs on Phono, carefully check the 220µF capacitors on the base of Q2 in each channel.

On the other hand, if the problem occurs on all inputs, check the values of the coupling capacitors in the preamplifier and tone control stages. These include the $0.22\mu F$ capacitor in series with the volume control wiper, the $22\mu F$ capacitor at the output of IC2 and the $6.8\mu F$ capacitor at the balance control.

In addition, you should also check the value of the bass control pot and the 0.01μ F capacitor across it.

Finally, we suggest that you check the 1μ F capacitor on the balance control wiper and the 47μ F capacitor connected to the base of Q7 via the $1k\Omega$ resistor.

UHF remote control switch

I am rather perturbed with a paragragh on page 25 of the January issue concerning the UHF remote control switch. It states that the loudspeaker or horn and side lights sound for approximately 0.2 seconds when the alarm is turned on and approximately 0.5 seconds when the alarm is turned off.

This would be unacceptable if this is the case and would be a complete giveaway to a professional thief. It would be very embarrassing and a bonanza to a professional in an enclosed carpark. (J.T., Bilinga, Qld).

• You are quite correct in assuming that the loudspeaker (or horn) sounds for approximately 0.2 seconds when the alarm is switched on and for 0.5 seconds when the alarm is switched off. This is in line with standard commercial practice and is quite acceptable in view of the very brief time periods.

Note, however, that you don't have to operate your horn or the blinker lights if you don't wish to — this feature is entirely optional. Instead, you may wish to mount a small 8Ω loudspeaker inside the vehicle and to use this for audible on/off indication.

Wants Band V version of UHF antenna

I am interested in the UHF TV antenna described in the May 1986 issue of EA. It was for band IV. In Adelaide, all five TV stations broadcast in UHF in band V on channels 43, 46, 49, 52 and 55. (SBS also broadcasts on channel 28 with the other four stations on VHF from Mt Lofty.)

Can you please advise what modifications should be made to the antenna described in EA to give good reception on channels 43 to 55, or for band 5?

• Essentially, redesigning the antenna to suit the channels you want would be a matter of scaling the dimensions to suit the higher frequencies. Our antenna was cut to favour channel 28 in band 4. To make it work to suit your purpose, all the antenna dimensions would all have to be reduced by a factor of 0.78, to favour channel 49.

We must emphasise that we have not tried making the antenna work at these higher frequencies and could not guarantee the results. Having said that, such a design could be expected to work well when modified. Have any readers tried modifying the design along these lines?

Notes & Errata

DIGITAL SOUND STORE (February 1987, File 1/MS/34): There is an error on the circuit diagram on page 94. The connection from pin 10 of IC2b to pin 5 of IC6b should in fact go to pin 4 of IC6b. The printed circuit board is correct.

Do computers play any part in your life?

If they do — or if you just want to find out about them — don't miss each month's issue of



A magazine for all computer users and enthusiasts, Your Computer has something for everyone — topical features on all aspects of the computing world, expert reviews of the latest software and hardware, up-to-the-minute information for business people, and even games and advice for hobbyists.

NEWS

Your Computer brings you all that's interesting, innovative and inventive in the microcomputing world — news of products, plans and politics to keep you up-to-the-date with what's going on in this fast-moving industry.

REVIEWS

The latest machines and software from all the computer manufacturers are reviewed each month in Your Computer. Keep informed about what's available, and use our reviews to help you assess which products are right for you.

TUTORIALS

Your Computer's tutorials include regular series on such popular subjects as the BASIC programming language and dBase II, probably the biggest-selling database program of them all. Written by such well-known industry experts as Les Bell, they're an invaluable aid to learning how to make computers work for you.

PROGRAMS

Your Computer regularly publishes all kinds of programs written by both professional programmers and readers, and ranging from games to business uses, utilities to additions and alterations to well-known programs.

All Your Computer's articles are written in everyday English, not computer jargon, so even if you're a beginner there's something for you in every issue. And our regular columns on all the popular brands of microcomputers are packed with enough information to get any newcomer straight into the exciting world of computing. At \$2.95 — less if you take out a subscription — Your Computer is going to cost you a lot less than its overseas rivals - and provide you with the latest information on the computer scene in Australia at the same time. Look for it every month at your newsagent.

EA marketplace EA marketplace

ADVERTISING RATES FOR THIS PAGE

SMALL ADS: The minimum acceptable size of 2 centimetres x one column costs only \$40. Other sizes up to a maximum of 10 centimetres are rated at \$20 a centimetre. CLASSIFIEDS: \$4 for 40 letters. Just count the letters divide by 40 and multiply by \$4, ROUND UP TO NEAREST WHOLE NUMBER. CLOSING DATE: Ads may be accepted up to the 18th of the month two months prior to issue date. PAYMENT: Please enclose payment with your advertisement. Address your letter to THE ADVERTISING MANAGER, ELECTRONICS AUSTRALIA, PO BOX 227, WATERLOO, NSW 2017.

FOR SALE

Into RS232/DB-25 interfacing? Save money and make your own mini-testers, break out boxes, 2 way gender benders, etc. Plated through boards \$5 each, 4 way gender bender boards \$16, 256K printer buffer short form kits from \$39, computer and printer switches \$12, serial board for buffer \$18. For more info send SAE to Don McKenzie, 29 Ellesmere Cres. Tullamarine 3043.

Bag 100 5mm LED: 34 red, 33 grn, 33 yel, \$12. Nylon cable ties 37/8" (98mm), \$3 per 100, \$25 per 1000. Free P&P. L.M.F. Products, PO Box 384, Cootamundra 2590.

The Bubble-Etcher: Is a perspex tank formed as a ½" wide vertical slot, and an air pump. Fill tank with etchant, immerse a PCB, start the pump, and the etching is done in 6 minutes, no stirring. Sesame Electronics, P.O. Box 452, Prahran 3181. Phone (03) 527-8807.

EX-ABC AUDIO TAPES: 1/4" wide on 101/2" Standard metal spool \$6.85. Robust metal spool \$12.85 7" spool \$2.25. 5" spool \$1.25. Post extra. Also in stock 1/2", 1" and 2" tapes. Waltham Dan, 96 Oxford St., Darlinghurst, Sydney. Phone (02) 331-3360.

AMIDON FERROMAGNETIC CORES: Large range for all receiver and transmitter applications. For data and price list and 105X220 SASE to: R.J. & U.S. Imports, P.O. Box 157, Mortdale, N.S.W. 2223. N.S.W. Geoff Wood Electronics, Lane Cove. Webb Electronics, Albury. A.C.T.: Electronic Components, Fyshwick Plaza. Vic: Truscott Electronics, Croydon. W.A.: Willis Trading Co., Perth.

MICROTEC MICE II EMULATOR:

MODEL Z80 64K BPP in circuit emulator. Serial 5112801006 on account of Summit Technology (Australasia) Pty Ltd (In Liquidation). Original invoice price \$7,086. Offers invited to Peat, Marwick, Mitchell & Co. Box H67, Australia Square. Phone (02) 239 7611 (Tom Riddell or Peter Van Weerdenburg).

NEW RADIO VALVES: For entertainment or industrial use. Waltham Dan, 96 Oxford St., Darlinghurst, Sydney, Phone (02) 331-3360.

WANTED

CIRCUIT DIAGRAM: For National R-2500 BA AM Radio will pay. Ph: (049) 63-4469 AH or PO Box S029A, Newcastle West, 2302.

SOMPUTER WORK POOK YEAR DOOK

Available at your Newsagent now!

Or simply send \$4.95 plus \$1.50 post and packing to The Federal Publishing Co, PO Box 227, Waterloo 2017 NSW.

A NEW CONCEPT FOR LOW VOLTAGE PROJECTS

COPPER FOIL TAPE: thin pure copper tape backed by special hi-tack adhesive. Current carrying capacity, 5 amps, FULLY TESTED at 24V 5A. Not recommended for mains voltage.

4mm...RRP \$8.03 6mm...RRP \$9.84 33 metre rolls
GIFFORD PRODUCTIONS
PO Box 62, St Kilda, Vic 3182. (02) 534 3462

DO YOU WANT TO BE A RADIO AMATEUR?

The Wireless Institute of Australia, established in 1910 to further the interests of Amateur Radio. conducts a Correspondence Course for the A.O.C.P. and L.A.O.C.P. Examinations conducted by the Department of Communications. Throughout the Course, your papers are checked and commented upon to lead you to a successful conclusion. For further information, write to:

THE COURSE SUPERVISOR W.I.A. (N.S.W. DIVISION)

P.O. Box 1066
PARRAMATTA, N.S.W. 2150.

GENERATE ELECTRICITY FROM THE SUN ARCO PV PANELS

M55B 53 WATTS 12V M75B 47 WATTS 12V

Provide power for pumping, lighting and refrigeration. Now only \$8/WATT.

ELANTE PTY LTD

382 CANTERBURY RD. SURREY HILLS, 3127 Ph: (03) 836-9966

PRINTED CIRCUIT BOARDS

Minimum postage & packaging on all EA & ETI Project PCBs.

Catalogue 1976-85 (inc components) \$1.50. PCBs made to order — 48 hr prototype service Bankcard/Mastercard.

Acetronics PCBs 112 Robertson Rd, Bass Hill 2197 (02) 645 1241

R.C.S. RAIDIO PTY. LTD.

Established 1933
IS THE ONLY COMPANY
WHICH MANUFACTURES AND
SELLS EVERY PCB & FRONT PANEL
published in EA and ETI
651 Forest Road Bexley 2207
AUSTRALIA

RING (02) 587 3491 FOR INSTANT PRICES 24-HOUR TURNAROUND SERVICE

E

T

O

C

A

R

A

G

E

O

0

E

E

C

ī

O

C

C

O

O

S



W

E

B

u

E

E

C

T

R

0

N

C

E

Q

u

D

M

E

N

T

&

C

0

M

P

0

N

E

N

T

LECTRONICS CENTRE

THIS MONTH'S SPECIALS * * POLYPROPYLENE CONE TOP QUALITY HI-FI WOOFERS

80hm Voice Coil — Foam Poly Surround — Sturdy Suspension — Fitted Moulded Gasket — Ferrite Magnet - 90 days factory warranty

Model Size Reson HZ Resp HZ Watts R M S Pri 12 POL 12" 25 30-4000 80 \$4 10 POL 10" 30 35-4000 60 \$3 \$44.00 \$82.00 30 35-4000 35 40-5000 \$39.95 \$73.95 \$34.95 \$64.95 50

P for 1 Speaker NSW \$4.80 VIC \$5.20 TAS \$6.25 WA/NT \$7.95 QLD/SA \$5.80 P for 2 Speaker NSW \$5.50 VIC \$7.20 TAS \$9.95 WA/NT \$11.45 QLD/SA \$8.20

5" Polypropylene Mid-Range Speaker to suit above Woofers P.O.A. **ETONE SPEAKER SPECIALS**

GENUINE FACTORY PRICES Reson Hz Freq Hz Watts Rms Price Ea or

8 or 15 Ohms 8 or 15 Ohms 45 40-6000 30 30-4000 4350 38cm 120 \$118.00 or \$233.00 P & P for 1 Speaker NSW \$5.90 VIC \$7.70 TAS \$9.80 WA/NT \$12.80 QLD/SA \$8.90 P & P for 2 Speaker NSW \$7.10 VIC \$10.70 TAS \$14.90 WA/NT \$20.90 QLD/SA \$13.10

LOOK AT THESE SUPER KITS



cluding crossover. Mono \$94.50 speaker kit inclu Stereo \$186.95

- 10" 60 watts R.M.S. HiFi 3 v

speaker kit inclu Stereo \$169.75

P & P for Mono NSW \$5.50 VIC \$7.20 TAS \$9.95 WA/NT \$11.45 QLD/SA \$8.20 P & P for Stereo NSW \$6. 50 VIC \$9.20 TAS \$12.50 WA/NT \$17.00 QLD/SA \$11.00

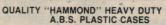
NEW



CANADIAN "HAMMOND" DIECAST BOXES Excellent quality

· Complete with C/S screws Interlocking flange on lid
Provides excellent RF shielding

1590B 109 × 58 × 25mm deep \$4.95 ea. 1590BB 116 × 91 × 28mm deep \$6.95 ea. 1590D 185 × 119 × 51mm deep \$13.95 ea. Above dimensions are external



 Interlocking flange on lid Integral card guides

· Continuous use Temperature rating of 70°C

 Truly a quality case for your project.

1591A 102 × 51 × 21mm deep \$3.43 ea. 1591C 121 × 65 × 36mm deep \$4.90 ea. 1591DS 152 × 80 × 47mm deep \$5.80 ea. 1591C Above dimensions are external.
P & P for 1590D \$3.50 All others \$2.00

******* BE A WINNER *****

All purchasers of goods exceeding the value of \$20.00 from 1st to 30th of April, 1987 inclusive, will automatically be entered in the ACE RADIO Guessing Competition. There will be three ed in the ACE HADIO Guessing Competition. There will be three prizes drawn, each prize consisting of a Standard 32K Basic Computer from our stock of preloved Microbee computers. Drawing will be in the offices of Electronics Australia by Mr. Selwyn Sayers, their Advertising Manager, on the 21st May, 1987. All issued Entry Forms must be received by ACE RADIO no later than the 8th of May, 1987 to qualify. Winners will be notified by mail and appear in July issue of E.A. by mail and appear in July issue of E.A

WE STOCK ONLY "QUALITY" BNC CODAN — TYPE 7007 AM CONNECTORS including Male Line Plug 3 CHANNEL MOBILE TRANSCEIVER Solderless "Twist on" type

"D" TYPE CONNECTORS

25Pin Male \$3.90 ea. Ext. Backshells \$2.60 ea. Backshells \$2.20 ea. P & P \$1.50 ea.

CAPACITOR SPECIALS

2UF 50vw Poly 10 for \$3.50 2UF 250vw Miniprint 10 for \$7.50 2.5UF 200vw Poly 10 for \$5.00 3.3UF 50vw Bi-Polar 10 for \$4.50 3.3UF 650vw Poly 4 for \$10.00 C. BOARD MOUNTING TRIMMERS 4-22PF Plastic Air spaced 10 for \$6.50 2-25PF Porcelain Compression 10 for \$6.50 Pack & Post for above \$2.50



Hybrid circuitry fully transistorized up to and cluding driver stage, with valve RF output age. Units in good clean condition. Circuit Diagram included. Crystals not supplied. \$35.00 ea. P & P NSW \$5.90. Interstate \$9.80

YES! WE HAVE RENEGOTIATED OUR POSTAGE. THUS WE ARE NOW PASSING THIS ADVANTAGE ON TO YOU THE CUSTOMER

microbee

COMPUTERS & COMPONENTS

Reconditioned "Pre-loved" Microbee 32K Memory Personal computers. These units are in good clean condition only requiring connection to a suitable 12VDC Power Supply & Interface cable to be put to work on your VDU.



A genuine bargain @ only \$210.00 ea. P & P NSW \$4.30 Interstate \$6.50

12VDC 1 amp Power Supply \$15.95. P & P NSW \$3.50 Interstate \$5.00

Arlec Power Transformer 240 to 9v @ 3A, 16v @ 2A. 16v @ 1A Special Price \$16.95 P & P NSW \$4.10 Interstate \$5.40

Computer Keyboard Switches 10 for \$2.00, P&P \$1.50.

New P.C. Boards (no components). MB1248 Motherboard \$12.50 MB8328 Coreboard \$10.95 File Server MB8313 \$0.50 Interface File Server MR8314 \$9.95 MB1011 Disk Controller \$4.95 MR8311 Dual Disk Power Supply \$3.95 MB8326 Disk Power Supply \$3.50 MB8308 R.G.B \$4.95 Conversion MB8341 Anti Glitch \$0.50 MB8346 Viatel \$0.50

New P.C. Boards (components mounted) MB8341 Anti Glitch Card \$3.50 MB8346 Viatel Card \$3.50 MB8319 Half Intensity Colour Interface & DB15 cable header \$3.50 P&P (any board) \$2.50

POWER PACK AC ADAPTOR * 240 to 3vac 300 ma \$6.95 ea. P & P \$1.95 ea.

> 216 BATTERY SNAPS * 10 for \$3.00 P & P \$1.50

* * AEI BRIDGES * * 150PIV 10 Amp \$2.25 ea. 10 for \$20.00

P & P \$2.00 FOR THE COMPUTER HACKER AND OTHERS

ASTEC UM1233 E36 Video Modulator-Adjustable Price \$5.50 ea. P & P \$2.00

* SEMI-CONDUCTORS *

\$1.10ea. 10up \$1ea. \$1.50ea. 10up \$1.35ea C106D C203YY \$0.90ea. 10up \$0.79ea C203B \$1.10ea. 10up \$0.92ea SC141D SC151D \$1.60ea. 10up \$1.40ea \$3.00ea. 10up \$2.80ea V275LA20A \$2.80ea. 10up \$2.50ea. V275LA40A \$3.10ea. 10up \$2.80ea. A14P \$0.80ea. 10up \$0.65ea \$1.50ea. 10up \$1.25ea IN4004 \$0.13ea. 10up \$0.10ea. \$0.13ea. 10up \$0.10ea. **RB154** \$1.10ea. 10up \$1.00ea \$7.00ea. 10up \$6.50ea. \$0.80ea. 10up \$0.75ea. CM3504 2N6027 ST2SYM (Diac) \$0.90ea. 10up \$0.75ea. ST4ASSYM (Diac) \$1.10ea. 10up \$1.00ea. 2N2646 (Met) \$1.30ea. 10up \$1.20ea. GES2646 (Plas) \$1.00ea. 10up \$0.90ea 4N25 (Opto Coup) \$1.50ea. 10up \$1.40ea. The above prices do not include P&P

" I.C. SPECIALS "

P & P \$2.00

MC10101 — MC10107,MC10109, MC10110,MC10113,MC10117, MC10119,MC10123,MC10128, MC10129,MC10130,MC10131 MC10134,MC10136,MCM10148, MCM10147,MCM10149,MC10159, MC10160,MC10162,MC10163, MC10164,MC10171,MC10173 MC10174,MC10175,MC10186, MC10188,MC10189,MC10195, LD3150,A4102,M53293,LD3120 TAA293,4585,MC1595,74LS138,74S04,74H51,7438.8126.8195. 8198,2104A3,LM3900,LM3401, LM3301,74157,A1230,TA7027 TA7122,A3300,A3350,4011, 7406,7441,7450,7104,7403 7430,7490,7407,MC1458 MC3456,7416,7421,74C00, RA08100N,MC14543. In case your preference is out of stock please indicate substitute for above 10 Mixed \$4.50 P & P \$2.00

TRANSFORMER SPECIALS

All Transformer **Primaries** 240VAC Secondaries:



No. 1 0-24v @ lamp \$5.95 2 0-12v @ 250m/a \$2 95 3 12-0-12v @ 500m/a \$3.95 4 0-40v @ 300m/a \$3.25 5 0-15v @ 1.5 amp & \$4.95 6.3v 6 0-17v @ 1a & 0-17v @ lamp \$10.50 20-0-20v @ 2 amp \$19.95 8 9v @ 3a & 16v @ 2A & 16v @ 1a \$16.95 P & P Nos. 1 to 5 inc. NSW \$3.50 Interstate \$4.50 P & P Nos. 6 to 8 inc. NSW \$4.10 Interstate \$5.40

TRIAC

TYPE 225D SENSITIVE GATE 400V. 10AMP

10 FOR \$19.50 or \$2.25 EA. P.P \$1.95



TRANSISTOR SPECIALS *

MJE350 \$1 ea. 10 for \$7.50 P&P \$2.00. BC337 20cea. 10 for \$1.70 P&P \$1.50

\$2.00 for parcel up to \$200.00 value plus FOR POSTAL INSURANCE ADD: \$2.00 for each additional \$100.00 value.

Next month in

Low cost mixer for PA work

This low-cost, easy-to-build mixer is just the shot for PA work. It adds on to your existing hifi amplifier and gives you two microphone inputs that can be mixed with line output material from the amplifier or a tape recorder.

Remotely controlled car alarm

Next month, we will give full details on marrying the ultrasonic burglar alarm described in this issue to the UHF remote switch described in January. Together they make an ideal car burglar alarm.

Plus:

An op amp tester to build, an Omega derived frequency standard, part two on restoring vintage radios, the story of Aussat, a car battery voltage monitor, and radar during WWII.

*Note: although these articles have been prepared for publication, circumstances may change the final content.

Electronics Australia Reader Service

"Electronics Australia" provides the following services: BACK ISSUES: available only until stocks are exhausted.

PHOTOSTAT COPIES: when back issues are exhausted, photocopies of articles can be supplied. Price: \$4 per project or \$8 where a project spreads over several issues. PCB PATTERNS: high contrast, actual size transparencies

for printed circuit boards and front panels are available. Price: \$5 for boards up to 100 square centimetres; \$10 for larger boards. Please specify positive or negative.

PROJECT QUERIES: advice on projects is limited to postal

correspondence only, and to projects less than five years old. Price: \$5. Please note that we cannot undertake spe-

OTHER QUERIES: technical queries outside the scope of "Replies by Post", or submitted without fee, may be answered in the "Information Centre" pages at the discre-

answered in the "Information Centre" pages at the discretion of the Editor.

PAYMENT: must be negotiable in Australia and made payable to "Electronics Australia". Send cheque, money order or credit card number (American Express, Bankcard, or Mastercard), name and address (see form). All prices include postage within Australia and to New Zealand.

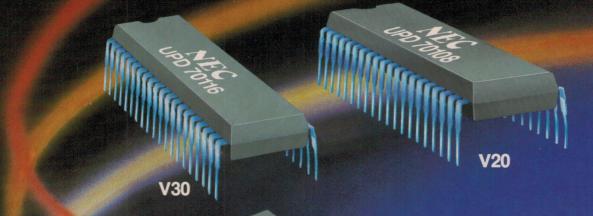
ADDRESS: send all correspondence to The Secretary, "Electronics Australia", PO Box 227, Waterloo, NSW 2017. Please note that we are unable to supply back issues, photocopies or PCB artwork material over the counter.

of our technical staff are not available to discuss t	
Back Issues	Photostat copies
	WINDOWN CHARLEST TO THE RESIDENCE AND THE RESIDE
Total price of magazines/photocopies, including postage and handling.	No off issues reg
Mastercard ☐ American Express ☐ Visa ☐ Bankcard	Card Expiry Date
NAME:	Signature (Unsigned Orders cannot be accepted)
ADDRESS:	AND CONTROL OF STREET OF S
	POSTCODE

ADVERTISING INDEX

Ace Radio	121
Acetronics	120
Active Wholesalers	
Altronics72	2-77
Amtex	117
Applied Communications	17
Armstron	120
Audio Engineers	85
Aust. Govt Recruiting	. 86
Chapman L.E.	
Cooper Tools	. 39
Crusader Electronics	110
David Reid	. 42
Diamond Systems	. 63
Dick Smith Electronics 5	5-62
Disco World	. 95
Elante	. 63
Elmeasco	. 89
Emtronics	. 20
Fairchild 4	0,41
Federal Publishing 90,114	,115
Geoff Wood	. 14
Gifford	120
ICS	110
Jaycar 2	2-27
Kalextronics	. 32
McDonnell Cowell Nicholl	OBC
Microbee 6	6,67
Micro Education	. 91
RCS Design	113
RCS Radio	120
Rifa	
Ritronics 31,34,35,98,99	,107
Scan Audio92	,108
Selectronics	. 87
Semicron	. 86
Siemens	IFC
Soanar	IBC
Stotts	105
TSA	. 93
VSI	. 46
WIA	120

NEC 8 & 16 BIT CMOS MICROS



White Services

White Construction of the Cons

- UPD 70108* (V20™) is a CMOS 16 bit microprocessor with internal 16 bit architecture and an 8 bit external data bus.
- UPD 70116* (V30™) is a CMOS 16 bit microprocessor with internal 16 bit architecture and a 16 bit external data bus.
- UPD 70208 (V40TM) is a high performance, low power, 16 bit CMOS microprocessor, integrating a number of commonly used peripherals to dramatically reduce the size of microprocessor systems. Instruction set is compatible with V20TM and V30TM.

Walter Jeb 10216

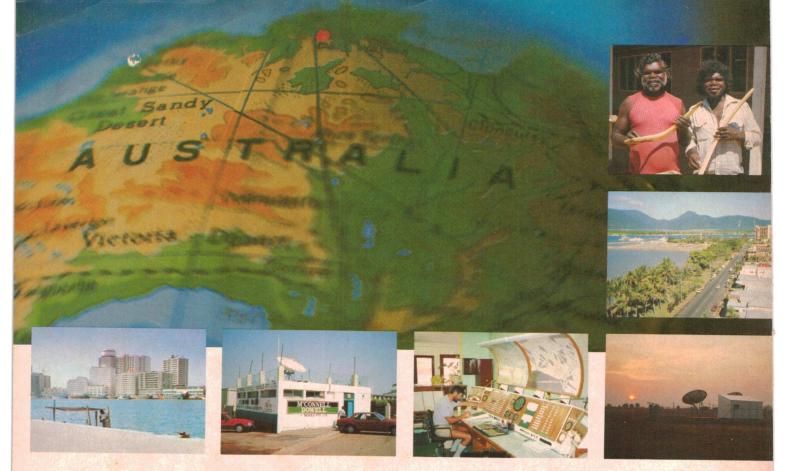
- UPD 70216 (V50TM) is a high performance, low power, 16 bit CMOS microprocessor with 16 bit external data bus. Instruction set is compatible with V20TM and V30TM.
 - * V20[™] and V30[™] instruction set is a super set of UPD 8086/8088. However, mnemonics and execution times are different.

FURTHER INFORMATION AVAILABLE FROM AUSTRALIAN DISTRIBUTOR



SOANAR ELECTRONICS PTY.LTD.

INCORPORATED IN VICTORIA 30-32 Lexton Road, Box Hill, Vic., 3128, Australia. Telex 34303 VICTORIA: 895 0222 N.S.W.: 789 6744 STH. AUST: 297 0811 QUEENSLAND: 852 1133 WEST AUST: 381 9522 TASMANIA: 31 6533



Skyswitch Talking to your world shouldn't cost the earth.

If your business world extends across the continent between specific facilities or to remote locations, the Skyswitch satellite communications system is your bottom line answer.

Skyswitch is compatible with standard PABX telephone systems. It just plugs into your existing phone network and works. Over land, water or ice; to branch offices, subsidiaries or distant exploration sites, Skyswitch has a reach that no landline can match.

For voice, data or facsimile, Skyswitch

provides transmission reliability so critical to the communication and safety needs of remote operations; so necessary to business efficiency.

Skyswitch is a communications system that you own and control or rent from us if you wish. Our use of exclusive software means you no longer have to pay for idle fixed lines or depend on the unreliable and non-private radio phone. Each Skyswitch transmission occupies its own separate channel with a clarity that surpasses the best land based communications system. And every

transmission station is monitored around-the-clock by a remote master station to check performance. The modular design of components make on-site maintenance or expansion of your system both fast and easy.

Skyswitch reaches into space with advanced technology, bringing costs down to earth. Contact us to have a communications analysis performed to compare the costs and reliability of our Skyswitch system to your present system.

20 Smallwood St., Underwood, Queensland. 4119. P.O. Box 706, Springwood, Queensland. 4127. Telephone: (07) 341-0788 Telex: AA144744 Fax: (07) 341-0804



NICHOLS PTY. LTD.

